

MATERNAL MENTAL HEALTH AND MATERNAL AND CHILD NUTRITION IN
EASTERN DEMOCRATIC REPUBLIC OF CONGO: A MIXED METHODS STUDY

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A dissertation submitted to Johns Hopkins University in conformity with the
requirements for the degree of Doctor of Philosophy

Baltimore, Maryland

January, 2017

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ABSTRACT

Maternal depression is associated with child underweight and stunting in low and middle-income countries, but evidence from sub-Saharan Africa is mixed and there are not studies in post-conflict, humanitarian settings where the population is at higher risk of post-traumatic stress disorder. There is little understanding of how maternal mental health is related to mothers' own diet and nutritional status. This dissertation aims to understand how maternal mental health problems are associated with maternal and child diet and nutritional status and child feeding practices in Eastern DR Congo.

The research was nested within a larger study evaluating Jenga Jamaa II, a United States Agency for International Development food assistance program. The larger study assessed household food security and child nutrition indicators for four Jenga Jamaa II interventions (Women's Empowerment, Prevention of Malnutrition in Children under 2 Approach, Farmer Field Schools, and Farmer-to-Farmer) and a control group.

Participants were eligible for the present study if they were enrolled in the parent study and had a child five years of age or younger also enrolled. There were 828 mothers and 812 children who participated. Mental health was measured using a questionnaire with items from the Hopkins Symptom Checklist- 25 (HSCL-25), measuring depression and anxiety symptoms, the Harvard Trauma Questionnaire (HTQ), measuring post-traumatic stress disorder (PTSD) symptoms, and 14 additional items measuring other locally-relevant symptoms. Average scale scores were calculated for HSCL-25 and HTQ subscales, and a variable for high psychological distress was created for participants with scores in the upper quartile of both measures. Regression analyses were used to evaluate the association between mental health measures and maternal dietary diversity, BMI, and

underweight, adjusting for confounding variables. Maternal mental health symptoms were then evaluated in relation to child diet (dietary diversity, meal frequency, achieving minimum dietary diversity, and achieving minimum meal frequency) and child anthropometry (height-for-age z score, weight-for-age z score, weight-for-height z score, stunting, and underweight). A qualitative analysis was conducted using in-depth interviews and focus group discussions with a sub-sample of 35 mothers who scored in the upper and lower quartiles of the mental health questionnaire to understand how maternal mental health affects child care and feeding practices from the mothers' perspectives. Key informant interviews were conducted among health workers. The qualitative analysis was conducted with methods adapted from Grounded Theory.

Higher levels of maternal mental health symptoms, indicating greater distress, were associated with higher maternal dietary diversity scores (HSCL-25: β : 0.18, $p=0.002$, HTQ: β : 0.13, $p=0.017$, High Distress: β : 0.27, $p=0.003$), but not with BMI or underweight. In the analysis evaluating children's diet and nutritional status, HSCL-25 (β : 0.18, $p=0.036$) and HTQ (β : 0.19, $p=0.026$) were associated with higher dietary diversity but not achievement of minimum dietary diversity (consuming 4 out of 7 food groups in the previous day). All maternal mental measures were associated with higher meal frequency (HSCL-25: β : 0.13, $p=0.001$, HTQ: β : 0.12, $p=0.001$, High Distress: β : 0.15, $p=0.014$). Maternal mental health was associated with achieving minimum meal frequency when defined by consumption of only three meals/snacks per day for non-breastfed children (HSCL-25: OR: 2.06, HTQ: OR: 1.93, High Distress: OR: 2.68, $p<0.001$ for all) but there was no association if the threshold was moved to four meals/snacks. No child anthropometric measures were associated with maternal mental

health. The qualitative research revealed that mothers perceived psychological distress to be related to loss of appetite and weight loss. Their distress, often combined with their weight loss, led to difficulties breastfeeding, mainly due to perceived milk insufficiency. The older age of the children and the lack of variation in outcome variables may have limited the study's ability to find an association with child growth. The positive association between higher levels of maternal mental health problems and maternal and child diet indicators warrants further study. Qualitative research results indicate a need for responsible parenting interventions targeted at fathers and increased breastfeeding support for distressed mothers.

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ACKNOWLEDGEMENTS

I am very grateful to the many individuals who have contributed their time and effort to this dissertation. First, I would like to express my deepest gratitude to my advisor, Dr. Laura Caulfield, for your patience, support, and encouragement throughout my doctoral program. I can't begin to quantify how much I've learned from you, and your mentorship has been integral to my development as a researcher. Thank you to Dr. Shannon Doocy for the opportunity to work on the Jenga Jamaa II study, and for the resources, feedback, and support that you provided for my dissertation research. I am very appreciative of the feedback and insights provided by my thesis and defense committee members Drs. Kristen Hurley, Wietse Tol, Nancy Glass, and Donna Strobino.

I am very much indebted to the ADRA staff in South Kivu, particularly Espoir Musafiri Kishimata and Jean-Pierre Nzanzu. This dissertation would not have been possible without your hard work in coordinating the research activities and your ability to navigate significant operational challenges. Thank you for looking out for me and for making me feel welcome every trip I took to Congo. Thank you to Rosa Rakotoarivelo and Solange Rajaofera Andriamasiarivelo for your hospitality in Uvira.

I would like to recognize the women who participated in this research; I am deeply appreciative of their generous contributions of their time and their willingness to share their experiences.

I am grateful to the Program in Human Nutrition for the financial support I received from the Bacon Field Chow Memorial, Harry J. Prebluda, and Harry D. Kruse Fellowships, and for the tuition support provided by the Department of International Health. I would also like to acknowledge the USAID Office of Food for Peace and the

Adventist Development and Relief Agency, who provided funding for the parent study.

To my International Health Doctoral cohort Vanessa Oddo, Julie Ruel-Bergeron, Samira Sami, Kath Shelley, Lauren Brown, Saba Rouhani, Brian Wahl, and Dan Erchick: thank you for creating such a fun and supportive environment these past few years. I'm so grateful to have made so many lifelong friends in this program. Thank you to Manish Shukla for being such a wonderful partner, your patience and love have carried me through the most challenging times. Finally, I am very grateful to my mother, Kate Emerson, for your unwavering support, for all of the opportunities you have provided me, and for always encouraging me to pursue my interests, no matter where in the world they have taken me.

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CHAPTER 1: INTRODUCTION

Maternal mental health problems are increasingly recognized for their role in adverse maternal and child health outcomes, particularly in low and middle-income countries (Surkan et al., 2011; Rahman et al., 2013; Gelaye et al., 2016; Herba et al., 2016). Maternal depression is one of the leading causes of disease burden in women globally, and symptoms of depression impede women's ability to function optimally in a caretaking role (Vos et al., 2012; Prince et al., 2007). Depressive symptoms in the perinatal period are associated with poor physical health, substance abuse, increased risk of pregnancy complications, and suicidality (Dewing et al., 2013; Alder et al., 2007). In the postnatal period, children of mothers with depressive symptoms are at risk for poor physical growth, as well as behavioral and developmental problems (Surkan et al., 2011; Engle et al., 2007; Black et al., 2007). Children of mothers with depressive symptoms are more susceptible to common childhood illnesses, particularly diarrheal diseases, and are less likely to have up-to-date vaccinations (Adewuya et al., 2008; Patel et al., 2003; Rahman et al., 2004a).

One pathway through which maternal mental health problems may lead to adverse child health outcomes is through poor child care and feeding practices. Maternal mental health problems are associated with sub-optimal child feeding practices, including early cessation of breastfeeding and non-responsive feeding styles, as well as insecure maternal-infant attachment (Rahman et al., 2016; Hurley et al., 2008; Tomlinson et al., 2005). However, studies evaluating relations between maternal mental health problems in sub-Saharan Africa have yielded mixed results. There also is little understanding of

how mothers' mental health problems might affect their own diet and nutritional status in low-income country settings.

In post-conflict, humanitarian settings such as Eastern Congo, the setting of the present study, risk for mental health problems and undernutrition are increased. The prevalence of major depression is estimated to be 30.8% in the aftermath of a humanitarian crisis compared to 5.4% for mood disorders in non-crisis settings, and there is an estimated 30.6% prevalence of post-traumatic stress disorder (PTSD) following crises compared to a 7.6% prevalence of anxiety disorders in non-crisis settings (Steel et al., 2009; Demyttenaere et al., 2004). According to a 2010 survey of North and South Kivu provinces, 40% of the population met symptom criteria for depression and 50% for PTSD (Johnson et al., 2010). Ongoing violence, especially sexual violence targeted at women, continues to traumatize the population even though a six-year long armed conflict officially ended in 2003 (Mukwege et al., 2010). The instability has led to a high prevalence of food insecurity and undernutrition in the Eastern provinces, and over half of children (53%) in South Kivu are stunted (height-for-age z score < -2) (*DRC DHS*, 2014). Relations between maternal mental health problems and child undernutrition in populations experiencing conflict-related trauma have not yet been evaluated.

This dissertation seeks to address these gaps in the literature in three separate analyses. The data were collected in the context of a larger study investigating the impact of a United States Agency for International Development-funded food assistance program in improving household income, food security, and child nutritional status in South Kivu, DR Congo. Chapter 2 reviews the existing literature on the link between maternal mental health problems and maternal and child diet and nutritional status and describes the

research objectives and study setting. Chapter 3 evaluates the association between maternal mental health problems and maternal diet and nutritional status. Chapter 4 examines the association between maternal mental health problems and the diet and nutritional status of young children. Lastly, Chapter 5 describes how maternal mental health problems affect mothers' functioning and child feeding practices, from mothers' own perspectives. Each chapter addresses a specific research question individually, and each contains a separate introduction and detailed presentation of the methods, analyses, results, and conclusions. Chapter 6 summarizes the results of the study and discusses its strengths, limitations, and implications for future research, policy, and programs.

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CHAPTER 2: BACKGROUND

This chapter includes the background and rationale for the study, as well as a description of the study setting and methods. It begins with a review of the epidemiology of depression, anxiety, and post-traumatic stress disorder (PTSD) symptoms, mental health in the perinatal period, and mental health in humanitarian settings. This review is followed by a description of the evidence for relations between women's mental health problems and their dietary intake and nutritional status, as well as the evidence for an association between maternal mental health problems and child undernutrition, and child care and feeding practices as a potential pathway for this association. The study objective and specific aims are introduced. Next, the context of Eastern DR Congo, the design for the parent study, and the design and methods for this dissertation are described.

2.1 LITERATURE REVIEW

Maternal and child undernutrition are estimated to be underlying causes of 3.5 million child deaths annually (Black et al., 2008). Undernutrition is associated with increased risk for morbidity and mortality in children under five years of age, mainly due to its detrimental effects on immunity, which make undernourished children susceptible to common childhood illnesses (Black et al., 2003; Scrimshaw & SanGiovanni, 1997). Long-term effects of child undernutrition include growth faltering leading to stunting, poor cognitive development, decreased economic productivity, and greater risk of chronic disease later in life (Victora et al., 2008). Stunting (height-for-age z score < -2) is associated with poor child behavioral outcomes including apathy and reduced activity and play, and poor growth in the first two years is associated with worse school

performance compared to children with normal growth (Aburto et al., 2009; Gardner et al., 1999; Martorell et al., 2010; Adair et al., 2013).

There are a variety of both direct and underlying causes of child undernutrition. At a macro-level, sociocultural, economic, and political factors impact household access to resources, including financial, human, and social capital (UNICEF, 2013). Lack of access to resources is associated with household food insecurity, inadequate care and feeding practices, and lack of adequate health services. These factors result in inadequate dietary intake and disease, which are direct causes of undernutrition (UNICEF, 2013). Growing evidence suggests that psychosocial factors, including maternal mental health, play an important role in child nutrition outcomes (Rahman et al., 2008).

2.1.1 Global Burden of Mental Health Problems

It is estimated that 20% of people in low and middle-income countries have experienced at least one episode of major depression, and globally 7% of the population has an anxiety disorder (Kessler & Bromet, 2013; Baxter et al., 2013). The 2010 Global Burden of Disease Project found that mental and substance abuse disorders combined were the leading cause of years lived with disability, and mental disorders are estimated to have caused \$2.5-8.5 trillion globally in lost productivity in 2010 (Whiteford et al., 2013; Bloom et al., 2011). Depression and anxiety symptoms are associated with lower socio-economic status and educational attainment; thus, poverty and mental health are intractably linked and addressing the burden of mental disorders has become an increasingly recognized priority for development initiatives (Patel & Kleinman, 2003; Lund et al., 2010; McKernan McKay et al., 2014).

Depression, anxiety, and substance abuse disorders are sometimes referred to as “common mental disorders,” and are highly comorbid (World Health Organization, 1992; Patel & Kleinman, 2003; Hirschfeld, 2001; Moffitt et al., 2007). It is estimated that 60-65% of depression diagnoses are comorbid with another mental disorder, and anxiety disorders, including generalized anxiety disorder and PTSD, represent approximately 60% of comorbid disorders (Blazer et al., 1994; Rush et al., 2005; Mineka et al., 1998). Symptoms of depression include feelings of sadness or hopelessness, lack of interest or pleasure, weight loss or weight gain, decrease or increase in appetite, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness and guilt, difficulty concentrating, and suicidal ideation (American Psychiatric Association, 2013).

Anxiety is characterized as the presence of excessive worry; symptoms include restlessness, becoming easily fatigued, difficulty concentrating, irritability, muscle aches or soreness, and difficulty sleeping (American Psychiatric Association, 2013). For a depression or anxiety disorder to be diagnosed clinically, it must impair functioning and affect an individual’s ability to carry out day-to-day activities (American Psychiatric Association, 2013).

Stressors, including negative events, chronic strains, and trauma, are major contributors to adverse mental health outcomes (Thoits, 2010). It is thought that chronic stress burden contributes more to psychological distress than negative events or traumas (Turner & Lloyd, 1999; Turner, 2003). Other factors contributing to mental health problems include genetic, neurological, hormonal, and environmental factors. One meta-analysis estimated that up to one-third of the risk for major depression is due to genetic variation (Sullivan et al., 2000). Genetic polymorphisms affecting genes in the serotonin

system, an important neurotransmitter for a variety of physiological functions, have been linked to depression and other psychological problems (Kendler et al., 2006; Lucki, 1998; Neumeister et al., 2004).

The disruption of the neuroendocrine system in another potential mechanism leading to mental health problems. The hypothalamic-pituitary-adrenal (HPA) axis controls the body's response to stress with the release of the hormone cortisol (Plotsky et al., 1998). HPA axis dysregulation leading to prolonged elevated levels of cortisol and other stress hormones is associated with poor emotional regulation and depression (Holsboer, 2000; van Rossum et al., 2006). Environmental and personal factors, such as negative life events, chronic life stress, childhood adversities, and certain personality traits such as neuroticism also contribute to risk for depression and anxiety disorders (Mazure, 1998; Kendler et al., 1998; Caspi et al., 2003; Kessler et al., 2003; Watson & Clark, 1984; Kendler et al., 2003).

Unlike depression and other anxiety disorders, diagnosis of PTSD requires exposure to a traumatic event, namely that the person was directly exposed to or witnessed death, threatened death, actual or threatened serious injury, or actual or threatened sexual violation (American Psychiatric Association, 2013). Symptoms include intrusive thoughts, nightmares, flashbacks, detachment, decreased interest in activities, inability to experience positive emotions, difficulty concentrating, sleep disturbance, hypervigilance, and destructive or reckless behavior (American Psychiatric Association, 2013). Some individuals are more vulnerable to PTSD following a traumatic event than others. Female gender, lower education level, being of an ethnic minority, prior history of chronic stress or other mental disorders, and severity of the

traumatic event are all risk factors (Breslau et al., 1998; Davidson et al., 1991; Yehuda & McFarlane, 1995; McFarlane, 1989). The duration of PTSD symptoms following a traumatic event varies by individual, but symptoms must persist for at least one month for diagnosis (American Psychiatric Association, 2013).

Mental Health in Humanitarian Settings

Eastern DR Congo, the setting of the present study, experienced one of the deadliest armed conflicts since World War II (Coghlan et al., 2006). Although it is no longer considered to be in an acute humanitarian emergency, it is still transitioning from a humanitarian setting and vulnerable to further outbreaks of armed conflict (Coghlan et al., 2006). Humanitarian crises refer to both natural disasters and complex emergencies due to armed conflict, and often result in widespread population displacement and subsequent increased mortality and undernutrition, especially in food insecure regions. Complex emergencies are characterized by extremely high levels of morbidity and mortality, often due to disease and undernutrition that occurs when populations are displaced and no longer able to access food, health care, adequate water and sanitation structures, and livelihoods activities (Al Gasseer et al., 2004; Egal, 2006).

Humanitarian emergencies are associated with increased incidence of mental disorders including PTSD, major depressive disorder (MDD), generalized anxiety disorder, substance abuse disorders, and adjustment disorder (Tol et al., 2011). A meta-analysis of traumatic events and mental health outcomes among populations exposed to mass conflict and displacement found an unadjusted weighted prevalence of 30% for both depression and PTSD symptoms each in post-conflict settings, much higher than the estimated 5.3% prevalence of mood disorders and 7.6% prevalence of anxiety disorders

in non-crisis settings (Steel et al., 2009; Demyttenaere et al., 2004). The elevated prevalence of mental health problems in conflict and post-conflict settings is often attributed to experiences of conflict-related traumatic events, such as witnessing killings and torture, being seriously injured, experiencing rape or sexual abuse, and lacking food, water, or shelter, as well as the destruction of social ties and societal structures that would normally help people cope with distress (Araya et al., 2007; Seguin & Roberts, 2015).

Global trends suggest that humanitarian crises are on the rise, yet there are still inadequate resources devoted to developing, testing, and implementing mental health and psychosocial support interventions in humanitarian settings (Development Initiatives, 2016; Tol et al., 2012). In 2015, 59.5 million people were displaced by war globally, which is the highest number ever recorded (United Nations High Commissioner for Refugees, 2015). The long-term psychosocial impact of these unprecedented levels of conflict and displacement is unknown.

Maternal Mental Health

Women may be especially vulnerable to depression in the perinatal period due to the major changes and challenges presented by childbearing (Alipour et al., 2012; Smith et al., 2011; Biaggi et al., 2016). It is estimated that 15.6% of women in low and middle-income countries experience symptoms of antenatal mental health problems and 19.8% experience symptoms of postpartum mental health problems (Fisher et al., 2012). Risk factors for perinatal mental health problems include socio-economic disadvantage, low educational attainment, age (younger women being at greater risk), being unmarried, and being of a religious minority (Chandran et al., 2002; Fisher et al., 2010; Rahman et al., 2003; Abiodun, 2006; Faisal-Cury et al., 2004; Ukpomg & Owolabi, 2006; Patel et al.,

2002; Melo et al., 2012). Poor relationships with intimate partners, intimate partner violence, and low social support are also important risk factors for perinatal mental health problems (Sawyer et al., 2010; Gomez-Beloz et al., 2009). Other risk factors include poor reproductive and general health, a prior history of mental health problems, not giving birth to an infant of the desired sex, and having a sick infant (Hanlon et al., 2009a; Xie et al., 2007; Chandran et al., 2002; Patel et al., 2002). Protective factors include education, employment (self or partner), and being part of an ethnic majority (Fisher et al., 2010; Faisal-Cury et al., 2004; Patel et al., 2002).

2.1.2 Maternal Mental Health and Maternal Diet and Nutritional Status

Maternal undernutrition has a wide range of detrimental effects on maternal and child health, thus it is important to understand the role that mental health plays in maternal diet and nutritional status. Maternal nutritional status has implications for pregnancy outcomes in low-resource settings, as well as for long-term infant and child health and development outcomes (Mori et al., 2012; Pharoah et al., 2012; Dror, 2011; Christian et al., 2009; Perez et al., 2005; King, 2000). Maternal short stature (height < 145 cm), due to growth stunting in childhood, is a risk factor for delivery complications, small-for-gestational age infants, and preterm birth (World Health Organization, 1995; Kozuki et al., 2015). Low maternal body mass index (<18.5 kg/m²) is also associated with increased risk of fetal growth restriction (Muhammad et al., 2010; Ota et al., 2011).

Deficiencies of certain micronutrients are especially detrimental in the perinatal period. Iodine deficiency increases risk of miscarriage, low birth weight, and poor cognitive and motor development of the infant (Dillon & Milliez, 2000; Das et al., 2006; Chaouki & Benmiloud, 1994; Gordon et al., 2009; Zimmermann et al., 2006). Adequate

folate status prior to conception is important for the prevention of neural tube defects, and poor folate status may increase risk for pre-eclampsia during pregnancy (Tamura & Picciano, 2006). Iron-deficiency anemia (IDA) is associated with increased risk for maternal mortality, as well as low birth weight (LBW) and perinatal mortality, and zinc deficiency is associated with risk of preterm birth (Imdad & Bhutta, 2012; Dibley et al., 2012; Stoltzfus, 2003; Mori et al., 2012). Maternal Vitamin A deficiency can cause night blindness, which has in turn been linked with low birth weight and infant mortality (Tielsch et al., 2008; Christian et al., 2001; Christian et al., 1998).

Among U.S. populations, studies have found that symptoms of anxiety and depression are associated with household food insecurity, increased energy intake, and decreased micronutrient intake among pregnant women (Laraia et al., 2006; Hromi-Fiedler et al., 2011; Hurley et al., 2005). Among postpartum women and adults more generally, symptoms of depression, anxiety, and stress have been linked with disordered eating attitudes and preference for sweet or energy-dense foods (Emerson et al., 2016; Torres & Nowson, 2007; Kontinen, 2010). Many studies in U.S. populations have found that symptoms of depression, anxiety, and stress are associated with overweight and obesity in adults (Blumel et al., 2014; Carter et al., 2000; Dallman, 2010; Singh, 2014).

Although mental health problems are often associated with overnutrition, there is some evidence for an association between mental health problems and eating disorder psychopathology, potentiating undernutrition (Kaye et al., 2004; Lowe et al., 2001; Vaz-Leal et al., 2014). Studies have found relations between depressive symptoms and BMI to resemble a U-shaped curve, where depressive symptoms are associated with both underweight and overweight in adults (Johnston et al., 2004; de Wit et al., 2009; Martin-

Rodriguez et al., 2016). This relation is consistent with DSM-V diagnostic criteria, as changes in appetite (decrease or increase), weight loss or weight gain, and changes in activity level (fatigue or restlessness) are all symptom criteria for major depression (American Psychiatric Association, 2013).

Relations between mental health symptoms and the nutritional status of women of reproductive age have not been widely evaluated in developing countries, however relations between food insecurity and mental health problems have been more widely assessed. One study in peri-urban South Africa found that symptoms of postpartum depression, food insecurity, and hazardous drinking were co-occurring in a sample of new mothers (Dewing et al., 2013). A nationally representative study of South African adults found that food insecurity was associated with having any 12-month or lifetime mental disorder (Sorsdahl et al., 2011). In rural Tanzania, seasonal food insecurity was associated with symptoms of depression and anxiety among female caretakers, and in Uganda social support moderated the association between depression and food insecurity among pregnant women (Hadley & Patil, 2008; Natamba et al., 2016). However, there has been no research exploring differences in maternal diet and nutritional status by mental health symptomatology in similar contexts.

Much evidence suggests a bi-directional relationship between mental health and nutritional status, as certain nutrient deficiencies affect cognitive function, and their symptoms sometimes overlap with common depression symptoms (Polivy & Herman, 2005). Iron deficiency is the most prevalent micronutrient deficiency among women of reproductive age globally, and is related to changes in mood, cognition, and behavior (Murray-Kolb & Beard, 2009). Fatigue, irritability, apathy, and other depression

symptoms are common among iron-deficient women (Murray-Kolb & Beard, 2009). In the postpartum period, maternal iron deficiency is associated with behavioral changes that negatively impact mother-child interactions and child development (Beard et al., 2005).

Zinc is important for the functioning of neurotransmitters, including dopamine and serotonin, and some studies have shown that depression is associated with lower plasma or serum zinc concentrations (DiGirolamo & Ramirez-Zea, 2009). In animal studies, zinc deficiency has also been shown to increase anxious behavior (Mlyniec et al., 2014). Folate and Vitamin B-12 may play a role in the synthesis and metabolism of neurotransmitters (Bodnar & Wisner, 2005). Deficiency of B vitamins may cause elevated concentrations of homocysteine, which are associated with depressed mood (Bodnar & Wisner, 2005; Folstein et al., 2007).

Polyunsaturated fatty acids (PUFAs) are structural components of phospholipid membranes in tissues throughout the body and especially in the brain. The increase in the ratio of omega-6 to omega-3 PUFAs in modern diets is thought to be related to increased incidence of depression (Maes et al., 1996; Edwards et al., 1998). Higher concentrations of DHA, an omega-3 PUFA, in women's breast milk is associated with decreased risk for depression (Hibbeln, 2002). Several studies have found improvements in depression symptoms with omega-3 PUFA supplementation (Peet & Horrobin, 2002; Nemets et al., 2002).

2.1.3 Maternal Mental Health Problems and Child Undernutrition

Maternal mental health problems in the postpartum period are associated with a variety of adverse child growth and development outcomes in low-income countries.

Symptoms of maternal depression are associated with poor infant motor development, mental development, and social performance (Patel et al., 2002; Galler et al., 2000; Black et al., 2007; Avan et al., 2010). One study in South Africa found that postpartum depression symptoms was associated with child behavior problems at two years of age, and in Brazil it was associated with delayed language development at 12 months of age (Avan et al., 2010; Quevedo et al., 2012). Children in Pakistan born to mothers with postpartum depression symptoms had higher odds of delayed emotional development, language development, and gross motor development (Ali et al., 2013).

The association between maternal mental health problems and child undernutrition has been documented in a number of studies. One meta-analysis showed that symptoms of maternal depression were associated with an odds ratio of 1.5 for underweight (Figure 2.2), defined as weight-for-age z score < -2, and 1.4 for stunting (Figure 2.3) (Surkan et al., 2011). The population attributable risk for maternal depression symptoms was estimated to be 22% for underweight and 27% for stunting (Surkan et al., 2011). The strongest evidence for a link between maternal mental health problems and child undernutrition comes from South Asia. One study in India showed significant associations between current major depression symptoms and low maternal intelligence with infant underweight (Anoop et al., 2004). Another longitudinal study in India showed that postpartum depression symptoms predict infant low weight and length (Patel et al., 2003). Similar results were seen in Pakistan, where a case-control study in an urban health clinic found increased odds of infant underweight with current maternal mental distress after adjusting for birth weight and socioeconomic factors (Rahman et al., 2004b). A prospective cohort study there identified antenatal depression symptoms as

increasing risk for stunting, underweight, and child diarrheal illness (Rahman et al., 2004a). Several studies in Bangladesh have shown that infants of depressed mothers had increased odds of stunting (Black et al., 2009; Nasreen et al., 2013).

The evidence from sub-Saharan Africa is mixed, and a variety of measures have been used to assess maternal mental health symptoms and child nutritional status. Some studies have assessed differences in prevalence of undernutrition between children of mothers with depressive symptoms and those without, while others have evaluated differences in children's mean weight and length/height measurements. In rural Nigeria, infants measured at 3 and 6 months postpartum were more likely to fall below the 5th percentile for both weight and length if their mothers had depression symptoms (Adewuya et al., 2008). However, anthropometric measurements were not associated with maternal mental health at 6 weeks and 9 months postpartum. Depression symptoms were assessed by trained psychiatrists using the Structured Clinical Interview for DSM-III (Spitzer et al., 1992).

Several studies in Ethiopia have found no association. Among pregnant women whose mental health status was assessed in their 3rd trimester and two months postpartum using the WHO Self-Reporting Questionnaire with a cut-off score of 6 to classify symptoms of mental health problems, no association was found with infant underweight and stunting at 6 and 12 months of age (Medhin et al., 2010; World Health Organization, 1994). In a cross-sectional study, Harpham et al. evaluated children 6-18 months of age, and found no association with stunting and underweight (Harpham et al., 2005). Maternal mental health was assessed using the WHO SRQ with a cut-off of 7. Another study in Ethiopia also classified mothers as having depressive symptoms if they scored

above 7 on the 20-item WHO SRQ, and found no association with child anthropometry, measured by stunting, underweight, wasting, and height-for-age, weight-for-age, and weight-for-height z scores among children 0-5 years of age (Nguyen et al., 2014). The same study also evaluated data from Bangladesh and Vietnam, and Ethiopia was the only country where maternal mental health symptoms were not associated with stunting.

A case-control study in Uganda among children admitted to a regional hospital defined cases as severely undernourished children (weight-for-age, height-for-age, or weight-for-height z scores < -3) and controls as children with other chronic conditions but normal nutritional status, and found an odds ratio of 2.4 (95% CI: 1.11-5.18) for the association between maternal depressive symptoms and child undernutrition (Ashaba et al., 2015). Children were 1-5 years of age, and maternal mental health was evaluated using the Mini International Psychiatric Interview, with mothers answering 'yes' to five or more questions classified as having depression symptoms (Sheehan et al., 1998). In Ghana, children of mothers with depression symptoms were three times more likely to be stunted compared to those of mothers without depression symptoms (Wemakor & Mensah, 2016). Mothers and children (0-5 years of age) were recruited from a child health clinic, and maternal mental health was measured by the Centre for Epidemiologic Studies- Depression module (CES-D) with scores above 16 out of 60 used to classify depressive symptoms (Radloff, 1977). In Zambia, a WHO SRQ score of 8 was used to classify mothers with mental health symptoms, and no association was found with infant (ages 2-12 months) weight and length below the 5th percentile (Ndokera & MacArthur, 2011). Lower mean weight and length was found for infants of mothers with symptoms of mental health problems.

In urban South Africa, researchers found no effect of postpartum depressive symptoms on growth after controlling for birth weight (Tomlinson et al., 2006). Assessments were conducted at 2 and 18 months postpartum, and weight-for-age and length-for-age z score were measured. Maternal depression was classified using the Structured Clinical Interview for DSM-IV (First et al., 1996). Another study in Nigeria which recruited patients from a hospital immunization clinic found that children of mothers with depression symptoms (screened first using the Edinburgh Postnatal Depression Scale and then classified with the MINI) had lower weight and length than those of non-depressed mothers (Bakare et al., 2014; Cox et al., 1987). Lastly, in rural Malawi, infants of mothers with symptoms of mental health problems had lower length-for-age, but not weight-for-age, compared to infants whose mothers did not have mental health symptoms (Stewart et al., 2008). The mother/infant pairs in this sample were recruited from a district hospital child health clinic. Scores above 8 on the SRQ were used to classify maternal mental health symptoms.

Evidence is mixed in studies conducted in the Latin America and Caribbean region. Maternal mental health problems were not associated with stunting in Peru (Harpham et al., 2005). Several studies in urban areas of Brazil have yielded conflicting results, and in Jamaica there was no significant association between maternal mental health and child underweight (de Miranda et al., 1996; Santos et al., 2010; Surkan et al., 2008; Baker-Henningham et al., 2003).

There are a variety of potential explanations for the heterogeneity in findings, including the unmeasured or incorrectly specified confounding variables, the time at which growth is measured, the degree of food insecurity, and other contextual factors that

differ between study populations (Surkan et al., 2011; Stewart, 2007). Poverty and maternal physical health status are potential confounding factors for the association between maternal mental health problems and child undernutrition, and some studies may have not adequately measured socio-economic status or accounted for maternal physical health (Stewart, 2007). Timing is also an important factor for measurement, as most studies reporting an association have found it among infants less than 12 months of age, when they are most vulnerable to the effects of depression symptoms on sub-optimal care practices. The results of cohort studies indicate that effects are strongest for infants between the ages four to six months (Rahman et al., 2004a; Patel et al., 2003; Rahman et al., 2004b; Anoop et al., 2004; Harpham et al., 2005; Stewart, 2007).

Stewart hypothesized that severe food insecurity may obscure relations between maternal mental health and child undernutrition, which may explain why studies in Ethiopia found no association (Stewart, 2007). Contextual factors attributed to stronger associations in South Asian contexts are that women may be under more pressure (for example to have a male child) and particularly disempowered, whereas in sub-Saharan Africa other caregivers may play a greater role in raising the child (Harpham et al., 2005; Stewart, 2007). Additionally, it is possible that having an undernourished child may cause maternal depression symptoms. Many of the cross-sectional studies showing positive associations may be reflecting mothers' depressive symptoms as a function of her child's failure to thrive, although no evidence exists to support this hypothesis. Longitudinal cohort studies are better designed to generate an understanding of the timing and nature of relations between maternal mental health and child undernutrition.

Another issue in interpreting the mixed results of these studies is that maternal mental health problems are measured using a variety of tools. The WHO Self Reporting Questionnaire is frequently used, which measures a combination of depression, anxiety, and somatic symptoms using 20 yes/no questions which are scored by assigning one point for each 'yes' response (World Health Organization, 1994). Studies have used varying cut-offs to classify maternal mental health problems using the SRQ, generally ranging from 6-8 out of a possible 20 points. Unlike the SRQ, most other measures are used to evaluate only depression symptoms, such as the Edinburgh Postnatal Depression scale (EPDS) and Mini International Psychiatric Interview. Other measures used are Structured Clinical Interviews, which are often used to diagnose depression (rather than assess symptomatology) according to the *Diagnostic and Statistical Manual of Mental Disorders* (Spitzer et al., 1992; First et al., 1996). Thus, it is difficult to compare studies when some use scales assessing symptoms using varying cut-offs to classify depression, and others are diagnostic.

The present study utilized a questionnaire that was developed for a prior study in South Kivu, DR Congo, based on formative research the Hopkins Symptom Checklist-25 (HSCL-25) was selected to measure depression and anxiety symptoms and the Harvard Trauma Questionnaire (HTQ) was selected to measure symptoms of PTSD (Bass et al., 2013; Derogatis et al., 1974; Mollica et al., 1992). The validity of the HSCL-25 has been assessed in Tanzania, a setting where Swahili is also the predominant language, and the HTQ has been widely used among conflict affected populations (Lee et al., 2008; Rasmussen et al., 2015; Mollica et al., 1999).

Child Care and Feeding Practices as a Pathway for the Association between Maternal Mental Health Problems and Child Undernutrition

The link between maternal mental health problems and child undernutrition may be mediated through child care and feeding practices. Maternal mental health problems are linked to suboptimal child feeding practices, lack of psychosocial stimulation and maternal-infant bonding, and poor hygiene and health-seeking behavior, all of which may impact children's growth and nutritional status (Prince et al., 2007; Rahman et al., 2008; Rahman et al., 2013). Certain symptoms of depression, particularly fatigue, feelings of hopelessness, and lack of self-confidence, can manifest behaviorally in reduced care-seeking behavior (Rahman et al., 2007; Stewart, 2007). In Pakistan, infants of depressed mothers (diagnosed with a structured clinical interview, the Schedules for Clinical Assessment in Neuropsychiatry) (Aboraya et al., 1998), had more diarrheal episodes than those of non-depressed mothers in the course of one year, and a previous study there showed that infants of depressed mothers were also less likely to have up-to-date immunizations (Rahman et al., 2007; Rahman et al., 2004a). Increased diarrheal incidence among infants of depressed mothers was also found in the study by Adewuya et al. (2008) described previously. One study in Ghana and Côte D'Ivoire found that children of mothers with depression symptoms, measured with the Patient Health Questionnaire (Spitzer et al., 1999), were more likely to have febrile illnesses than those of mothers without symptoms at 3 and 23 months postpartum (Guo et al., 2013). The link between maternal mental health problems and child diarrheal disease could be due to poor hygiene behaviors like not washing hands before feeding, unsafe food preparation,

and failure to obtain clean drinking water, as well as children not receiving recommended vaccinations (Rahman et al., 2007; Patel et al., 2003).

Maternal depression and anxiety are associated with child feeding problems, including early cessation of breastfeeding and non-responsive feeding styles. The WHO and UNICEF recommend putting infants to the breast within one hour after birth, exclusively breastfeeding for the first six months of life, and continued breastfeeding for an additional 18 months, along with feeding age-appropriate complementary foods (World Health Organization and UNICEF, 2003). Adewuya et al. (2008) found that depressed mothers were more likely to stop breastfeeding at every follow-up assessment (6 weeks, 3, 6, and 9 months postpartum). One study in India found that mothers with depression symptoms had three times the odds of reporting problems with breastfeeding (Patel et al., 2002). In rural Pakistan, maternal depression (assessed using the Structured Clinical Interview for DSM-IV) was associated with perceived milk insufficiency, and stopping exclusive breastfeeding earlier than non-depressed mothers (Rahman et al., 2016). In Turkey, mothers with depression symptoms, measured with the EPDS, were more likely to stop breastfeeding by infant age of four months (Akman et al., 2008). In a longitudinal cohort of Barbadian mother-infant pairs, there was a significant association between maternal depressive symptoms and feeding attitudes, as mothers with depressive symptoms were less likely to believe that breastfeeding was better for the infant, and more likely to describe it as a “private” or “restrictive” practice, and these attitudes negatively influenced the duration and type of breastfeeding (Galler et al., 2006).

Additionally, maternal anxiety and depression are associated with non-responsive feeding behaviors. Responsive feeding refers to a reciprocal relationship between mother and infant, in which a mother responds appropriately to the infant's cues of hunger and satiety, and non-responsive feeding (controlling, indulgent, or uninvolved) can disrupt the infant's cues (Black & Aboud, 2011). Depressed mothers may be less likely to recognize signs of hunger and fullness, and their children have shown more anxiety and greater unpredictability in their feeding habits (Ammaniti et al., 2004; Hurley et al., 2008). In a sample of low-income mothers in the U.S., maternal symptoms of stress, depression, and anxiety were associated with non-responsive feeding styles, and other studies have shown that depression symptoms alone were related to controlling and less sensitive feeding behavior (Hurley et al., 2008; Haycraft et al., 2013). The association between maternal mental health and feeding styles is important to consider, as non-responsive feeding can influence infant dietary intake (Moore et al., 2006; Ha et al., 2002; Aboud et al., 2009). Furthermore, depressed mothers may be more withdrawn, apathetic, and less emotionally sensitive, affecting mother-child interactions and attachment (Akman et al., 2008; Carter et al., 2001). Maternal depression has been linked to reduced interest in child-rearing in several studies (Cooper et al., 1999; Rauh et al., 1990).

Child feeding practices may be mediators in the association between maternal mental health and child nutrition, and they are also related to a variety of adverse child health outcomes. It is estimated that 11% of child deaths are associated with suboptimal breastfeeding practices, and poor child feeding practices are related to increased child morbidity, lower intelligence, and increased risk for overweight/obesity later in life (Black et al., 2013). Sub-optimal child feeding practices and maternal mental health

problems share many of the same risk factors, included low socio-economic status, women's disempowerment, and intimate partner violence (Kendall-Tackett, 2007; Sethuraman et al., 2006; Ziaei et al., 2014).

In summary, studies have found that maternal mental health problems are associated with poor child nutritional status in a variety of contexts. Symptoms of depression and anxiety lead to functional impairment, which has a detrimental impact on the child care and feeding practices of distressed mothers, contributing to poor child growth. Most studies have evaluated maternal depression in relation to child nutritional status, thus relations between maternal PTSD and child nutrition outcomes necessitate greater understanding. There has been little research on how maternal mental health is related to mothers' own diet and nutritional status, as most studies in low-income country settings assess food insecurity, rather than diet and nutritional status, in relation to mental health problems. Generating further understanding on how maternal mental health affects the maternal-child dyad in post-conflict, humanitarian settings is important for the design of maternal and child health interventions.

2.2 RESEARCH QUESTIONS

The study objective is to evaluate relations between maternal mental health problems and maternal and child diet and nutritional status in South Kivu, DR Congo, and the role that child feeding practices and contextual factors unique to the post-conflict, humanitarian setting may play in understanding these relations. The specific aims and hypotheses addressed in this dissertation are as follows:

Aim 1: To examine the association between maternal mental health problems and the diet and nutritional status of mothers of young children.

Hypothesis 1: Higher symptoms of mental health problems among mothers are associated with lower dietary diversity, lower BMI, and increased odds of underweight.

Aim 2: To examine the association between maternal mental health problems and the diet and nutritional status of young children.

Hypothesis 2: Higher symptoms of maternal mental health problems are associated with lower dietary diversity and meal frequency and decreased odds of achieving minimum dietary diversity and minimum meal frequency. Higher symptoms of maternal mental health problems are associated with lower height-for-age, weight-for-age, and weight-for-height z scores, and increased odds of stunting and underweight.

Aim 3: To understand the role of contextual factors and mothers' perspectives on the link between maternal mental health, child feeding practices, and child undernutrition.

2.3 STUDY SETTING AND METHODS

Data collection for this dissertation was conducted in the context of a larger study evaluating the effectiveness of the Jenga Jamaa II, a USAID-funded multi-year assistance program implemented in South Kivu, DR Congo (Mathys & Remancus, 2010). This section describes the study setting, including the Eastern Congo context, the design of the parent study, and the methods for the present study.

2.3.1 The Context of Eastern DR Congo

The Democratic Republic of Congo (DRC) is recovering from years of armed conflict that involved six neighboring countries and took the lives of almost four million people (Coghlan et al., 2006). Following the Rwandan genocide in 1994, millions of Hutus fled to Eastern Congo, fearing reprisals from the newly installed Tutsi government. The Rwandan Tutsi army then invaded, and marched to the capital Kinshasa to help

depose Mobuto Sese Seko and install Laurent Kabila in power. This conflict was known as the First Congo War, and lasted from 1996-1997. The Second Congo War began in 1998 when Rwanda invaded again and tried to depose Kabila with help from Uganda and Burundi. Angola, Namibia, Chad, and Zimbabwe joined the fight on Kabila's side. The conflict officially ended in 2003, but insecurity, largely due to natural resource extraction, continues in its eastern provinces of North and South Kivu (Mukwege et al., 2010).

The continued fighting has been characterized by high rates of sexual violence, which has had a devastating impact on the mental and physical health of the population (Mukwege et al., 2010). One survey conducted in North and South Kivu in 2010 reported that 50% of the population had symptom criteria for PTSD and 40% had symptom criteria for major depression (Johnson et al., 2010). North Kivu province has one of the highest rates of sexual violence (205 women reporting rape per 1,000 women of reproductive age), although it is highly prevalent nationally as well (Peterman et al., 2011). Estimates of the percentage of women who have experienced sexual violence in Eastern Congo range from 40-75% (Johnson et al., 2010; Kelly et al., 2011). Sixty-seven percent of households have experienced conflict-related human rights violations (Johnson et al., 2010). Rape is often used by armed groups for its psychological effects on the community, as it is often perpetrated in public and in the presence of family members, with the intention to humiliate the victims and their families (Mukwege et al., 2010). Shame, stigma, and social isolation have been consistently reported by sexual violence survivors in Eastern Congo (Kelly et al., 2012; Kelly et al., 2011).

In South Kivu, conflict-related trauma and sexual assault were associated with rejection by family and poor mental health, and in North Kivu women who experienced conflict-related sexual violence had more psychological distress and post-traumatic stress symptoms (Kohli et al., 2014b; Dossa et al., 2014). In addition to conflict-related sexual violence, intimate partner sexual violence (IPSV) is highly prevalent in the Congo, with one study finding that 228 per 1,000 women of reproductive age experienced IPSV nationally, compared to 122 per 1,000 reporting rape (Peterman et al., 2011).

In addition to the high prevalence of sexual violence and mental health problems, maternal and child undernutrition are significant public health problems in the DRC. According to the 2013-2014 Demographic and Health Survey (DHS), 43% of children under five years of age are stunted, 8% of children are wasted (weight-for-height z score < -2) and 23% are underweight nationally. South Kivu province has one of the highest rates of stunting, at 53%. The prevalence of underweight is estimated to be 21%, and the prevalence of wasting is estimated to be 4%.

In terms of women's nutritional status, 5% of women in the DRC have short stature (height < 145 cm), 14% are underweight (BMI < 18.5 kg/m²), 16% are overweight (BMI > 25 kg/m²), and 38% are anemic nationally. The prevalence of women's short stature in South Kivu is 11%, 7% of women are underweight, 26% are overweight, and 22% are anemic (DRC DHS, 2014). Women's diets generally consist of starchy staples, namely *fufu*, made from cassava or corn flour, beans, meat, and cassava leaves, with intake of fruit and other vegetables generally poor (Burns et al., 2016). Less than 10% of women in South Kivu received an iron supplement for more than two months during their

last pregnancy, and only about 20% received Vitamin A supplements postpartum (*DRC DHS*, 2014).

Breastfeeding is highly prevalent (98% nationally); however, only 52% of children are breastfed within the first hour after birth (*DRC DHS*, 2014). Only 48% of children are exclusively breastfed for the first six months following WHO/UNICEF recommendations, and the median duration of exclusive breastfeeding is 3.6 months in South Kivu (*DRC DHS*, 2014). Exclusive breastfeeding for the first six months of life is promoted by the DRC Ministry of Public Health, with education and support provided to mothers during antenatal and postnatal consultations (Balaluka et al., 2012). However, more than one-third of women do not have access to a health clinic, and are thus not receiving information on optimal IYCF practices (Balaluka et al., 2012). In South Kivu, only 15% of children achieved WHO/UNICEF indicators for minimum dietary diversity, and 28.9% achieved minimum meal frequency. Only 3.8% achieved minimum acceptable diet (a composite indicator for both dietary diversity and meal frequency), compared to 9% nationally (*DRC DHS*, 2014).

Failure to exclusively breastfeed from 0-6 months and poor complementary feeding practices may contribute to the large number of deaths from common childhood illnesses, especially diarrhea and pneumonia (Yotebieng et al., 2013; Emina & Kandala, 2012). These factors are compounded by the high fertility rate in the DRC (6.6 children per woman), low vaccination coverage (45% of children 12-23 months have received all recommended vaccines), and a malaria prevalence of 23% among children under five years (*DRC DHS*, 2014).

Formative research conducted in 2011 in the study area revealed a number of barriers to optimal child feeding practices (Burns et al., 2016). Poverty overwhelmingly prevents mothers from providing meals with adequate frequency and dietary diversity. Nutrient-dense foods are expensive or unavailable, and a high workload limits mothers' ability to care for their children. The staple foods of most households are *fufu* and *sombé*, a sauce made from cassava leaves. Children tend to eat with the rest of the family, and most women and children eat only one or two times per day. Even when nutrient-dense, animal-source foods are available to the household, they are often sold for additional income. Most mothers breastfeed well into the child's second or third year, but exclusive breastfeeding for the first six months after birth is rare and many mothers reported difficulty breastfeeding by three to four months after birth.

2.3.2 The Jenga Jamaa II Program

The Office of Food for Peace is situated within the US Agency for International Development (USAID), and its multi-year assistance programs offer development aid to increase household income, improve food security, and prevent chronic undernutrition in food insecure regions. From 2008-2011, the Jenga Jamaa I program was implemented in Fizi and Uvira territories of South Kivu by the non-governmental organizations Adventist Development and Relief Agency (ADRA) and Africare. "Jenga Jamaa" is loosely translated as "building community" in Swahili. Jenga Jamaa I targeted individuals recently repatriated from refugee camps in neighboring countries, following a peace accord signed in 2008 between the Congolese government and the armed groups. The objective of Jenga Jamaa I was to provide resettlement support and increase crop

productivity and access to markets for these vulnerable households in Uvira and Fizi territories (TANGO International, 2011).

Following Jenga Jamaa I, the second Jenga Jamaa was implemented from 2011-2016. Jenga Jamaa II objectives were to increase income among food-insecure farming households through agriculture interventions, improve the health and nutrition of young children, and empower women by providing literacy training and access to income-generating activities, reducing gender-based violence, and increasing participation in decision-making at the household and community levels. Jenga Jamaa II aimed to reach over 162,000 individuals over the five-year period of the project, with 11,480 beneficiaries enrolled in specific interventions in Fizi and Uvira territories.

Jenga Jamaa II programs were implemented by ADRA in Uvira and Fizi territories, and by World Vision in Kalehe territory. Some communities received only one intervention, and some received a combination of interventions, based on several considerations. Level of food security, feasibility of agricultural approaches, access to health services, logistics and security, and the willingness and interest of the community members, were factors affecting the selection of communities for participation. The intervention approaches are described below.

Farmer Field Schools

The program employed two approaches to improve agricultural outcomes: Farmer Field Schools (FFS) and the Farmer to Farmer (F2F) program. Farmer Field Schools were created as groups of 30 participants who were provided training and materials, such as improved seeds and tools, to strengthen and diversify agricultural productions. FFS sessions lasted for one year, after which participants transitioned to

Farmer Business Associations. The Farmer Business Associations provided opportunities for further agricultural training and support for marketing and production.

Farmer-to-Farmer

The Farmer to Farmer approach was designed to achieve the same agricultural outcomes as the Farmer Field Schools, with fewer inputs. Using a dissemination approach, each Farmer Field School participant picked three other community members and trained them in the same agricultural techniques that they learned through the Jenga Jamaa II program.

Prevention of Malnutrition in Children under 2 Approach

The program targeted nutrition using the Prevention of Malnutrition in Children under Two Approach (PM2A), which uses ration provision and behavior change communication as strategies to prevent maternal and child undernutrition. In PM2A groups, pregnant and lactating women and children six months to two years of age received rations, and an additional ration was provided for the household to prevent sharing of the targeted rations. The rations consisted of corn-soya blend flour (CSB) and vegetable oil, and children 6-24 months of age were intended to receive a monthly ration of 120 grams of CSB and 12 grams of oil per day, providing 557 calories per day. Rations for pregnant and lactating women contained 260 grams of CSB and 18 grams of oil per day, providing 1,139 calories per day.

PM2A participants also joined Care Groups, with volunteer mothers in their communities leading sessions on homestead gardening, maternal health and nutrition, infant and young child feeding practices, management of childhood illness, hygiene, and sanitation. PM2A groups were formed in areas that had access to health centers, as

routine child preventive care is an important component of the approach. ADRA, the implementing partner, provided support to health facilities through staff training and the provision of medicines and other supplies. PM2A evolved from a cluster randomized trial in Haiti which showed the effectiveness of a preventive approach to stunting targeted in the first 1,000 days of life, and has since been adopted by USAID food assistance programs in a number of countries (Ruel et al., 2008; FANTA-2, 2010).

Women's Empowerment Groups

Women from vulnerable, female-headed households, were targeted for participation in Women's Empowerment Groups (WEG). Participants received training on topics including financial management, literacy, numeracy, and leadership. Economic support was provided through sessions on labor-saving skills and training and material inputs for income-generating activities, such as goat-rearing, fish-drying, and cassava-processing.

2.3.3 The Jenga Jamaa II Study

The parent study for this dissertation was a four-year longitudinal study designed to evaluate the effectiveness of the Jenga Jamaa II interventions in improving household food security and child nutrition outcomes. The parent study had a quasi-experimental design, with a control group enrolled of individuals from households not receiving any Jenga Jamaa II interventions.

Subjects and Enrollment

Due to logistical considerations, the study area was restricted to Uvira and Fizi territories, where interventions were implemented by ADRA, as opposed to Kalehe territory, where the interventions were implemented by World Vision. Communities that

received more than one intervention were not eligible for enrollment, as the goal of the evaluation was to measure the effect of the specific interventions. Communities were stratified by territory and livelihoods zone (mountains, plains, lakeside), and selected based on relative proximity to other communities enrolled and project staff's perceptions of their similarity with regard to socio-demographic characteristics and livelihoods activities.

Individuals were enrolled in the Jenga Jamaa II study at the level of the intervention groups, with participants recruited from across the four intervention groups (WEG, PM2A, FFS, and F2F). An overview of the selection process is illustrated in Figure 2.1. There were 4,000 beneficiaries participating in the FFS intervention and 12,000 beneficiaries in the F2F intervention at the time of study enrollment. Thirteen villages were selected in which the agriculture interventions (FFS and F2F) were implemented. In each village, all 30 FFS beneficiaries were enrolled. Each FFS beneficiary was then asked to provide the names of three F2F beneficiaries in their village, from which one was chosen randomly for enrollment in the study. F2F beneficiaries were ineligible to be study participants if they were living in households with FFS or other F2F beneficiaries. Thus there were 13 groups of 30 FFS participants and 13 groups of 30 F2F participants, for a total of 390 participants in each group.

There were 4,482 mother-child pairs who participated in the PM2A interventions. Thirteen PM2A groups were selected for the study, and 30 beneficiaries were selected for enrollment in the study from each of the 13 groups, for a total of 390 PM2A mother-child pairs. Study staff attempted to enroll seven pregnant women, seven lactating women, and 16 mothers of children under two from each group selected for participation in the study,

however if that distribution of participants was not feasible, participants were selected randomly from the remaining PM2A beneficiaries in that group.

The WEG intervention had 2,596 beneficiaries, and thirteen WEG villages were selected for study enrollment. Each WEG selected had 25 beneficiaries, for a total of 325 WEG study participants. Women from WEG communities who were not beneficiaries of any Jenga Jamaa II intervention were matched to each WEG participant, yielding a total of 325 control group participants.

Enrollment for each group was conducted at group meetings or in the respondents' home. WEG, PM2A, and Control group members were all women. The PM2A group was the only one in which having children (0-2 years of age) was required for participation. FFS and F2F beneficiaries included both men and women. However, the parent study attempted to interview the female head of the household (when primary program beneficiaries were men) during data collection when possible.

All children of study participants born between July 2010 and December 2012 were enrolled in the study. Children were selected in this age range in order to compare the interventions' effects on child growth. PM2A group children were eligible for rations (age 6-24 months on July 1, 2012, born between July 2010 and December 2011) or their mothers received rations because they were pregnant (children born between July 2012 and December 2012) or lactating (children 0-6 months of age, born between January 2011 and June 2012). Children from other intervention groups and the control group were enrolled in the same age range of children exposed to PM2A rations in order to facilitate the comparison of growth indicators between groups. Overall there were 1,385 children from 1,243 of the 1,820 total households enrolled (some households had

multiple children in the eligible age range). Table 2.1 displays the number of children enrolled per group at each data collection period over the course of the study.

Consent Process

The consent process was conducted at enrollment by Jenga Jamaa II program staff and members of the research team, who received training on human subjects research and informed consent. Households that agreed to participate were asked for consent to enroll their child(ren), if eligible. Consent was administered orally in Swahili due to the low levels of literacy among the study sample. The consent script was pilot tested prior to enrollment, and consent was requested at every subsequent data collection encounter in which participants were reminded that participation was voluntary and that they could decline to participate at any point.

Data Collection

Data for the Jenga Jamaa II study were collected via surveys conducted every six months from August 2012 through March 2016. The surveys were designed around six-month intervals to account for seasonality in food security measures. August/September were purported to be the early lean season and a more food insecure period, and February/March represented the end of the rainy season, and a more food secure period. However, seasonality was not so clear, as some study staff described three seasons, and different crops were harvested at different times of year. Thus there were no clear-cut lean/harvest seasons as initially presumed.

The survey questionnaire focused on measures of food security, household income, and infant and young child feeding practices. The anthropometric measurements (height/length, weight, and mid-upper arm circumference) of children enrolled were also

recorded during the surveys. Once per year, supplemental questionnaires measuring indicators specific to each intervention group were administered. Survey instruments were developed in English and translated to Swahili, the predominant local language.

2.3.4 Present Study: A Sub-study of the Jenga Jamaa II Study

This section outlines the study design for this dissertation, which was nested within the Jenga Jamaa II parent study. The objectives and hypotheses of the sub-study were outlined in section 2.2.

Conceptual Framework

The conceptual framework in Figure 2.4 guided the methodological approach. In the study setting structural factors including poverty, political instability and conflict, and the low status of women have led to many underlying causes of both maternal mental health problems and maternal & child undernutrition, including food insecurity, sexual violence exposure, and lack of access to preventive services. These factors have direct effects on maternal mental health, maternal nutritional status, and children's nutritional status. Maternal mental health affects child nutritional status through poor child care and feeding behaviors. There is evidence for a bi-directional association between poor maternal diet and maternal mental health problems, with mental health problems increasing risk for poor diet and undernutrition. Having a child who is undernourished may in turn negatively affect maternal mental health. Mothers who are undernourished are more likely to low birth weight or growth restricted infants, who may continue to experience growth faltering through childhood.

Variables of Interest

Key variables for the quantitative aims of this dissertation are outlined in Table 2.2. The following text describes each variable and its data source.

Background and Demographic Indicators: The Jenga Jamaa II parent study questionnaire included questions on household size and household income (in the past month). Level of household food insecurity was measured using the Household Food Insecurity Access Scale (HFIAS), which measures access to food on a continuous scale (range 0-27), with higher scores indicating more severe food insecurity (Coates, 2007). Participants were then classified into categories of food insecurity (ranging from food secure to severely food insecure) based on responses to specific aspects of the HFIAS questionnaire. Additional demographic questions were included as part of the mental health questionnaire: age, years of education obtained, marital status, ethnic group, parity, number of children currently alive (used to construct an indicator for having a child that died), and current pregnancy.

Variables for membership in one of the four intervention groups or the control group were created, as well as for geographic location (Uvira or Fizi territory) and livelihoods zone (plains, lakeside, or mountains). Participants were asked whether they were currently living in their territory of origin, as population displacement occurred frequently in this region.

Maternal Mental Health: Maternal mental health was assessed using a questionnaire adapted from the DRC Gender Based Violence (GBV) Psychosocial Evaluation for a study previously conducted in South Kivu (Bass et al., 2013). The DRC GBV Psychosocial Evaluation was developed following qualitative studies in three linguistically different communities in South Kivu to identify mental health problems of

sexual-violence survivors. On the basis of the findings, the Hopkins Symptom Checklist (HSCL-25) was selected to assess depression symptoms (15 items) and anxiety symptoms (10 items) and the Harvard Trauma Questionnaire (HTQ) to assess PTSD symptoms (16 items) (Derogatis et al., 1974; Mollica et al., 1992). Fourteen additional items were included in the questionnaire that captured locally-relevant symptoms identified in the qualitative research that were not captured by the HSCL-25 and HTQ items, such as fear of stigma (Bass et al., 2013). Table 2.3 displays all of the items measured for each component of the mental health questionnaire.

Participants rated the frequency of each symptom in the prior four weeks on a four-point Likert scale, with scores ranging from 1-4. One item on suicidality was excluded from the HSCL-25 for this study due to ethical considerations. Mean item scores for the HSCL-25 and HTQ were calculated, and a variable was constructed for high psychological distress, identifying participants whose mean item scores were in the upper quartile of both measures. The 14 additional locally-relevant items were not used for the main analyses (Chapters 3 and 4), as they were highly correlated with the established scales. Cumulative mean item scores for the mental health questionnaire, consisting of HSCL-25, HTQ, and locally relevant items were calculated to sample participants in the upper and lower quartiles for the qualitative research described in Chapter 5.

Lastly, participants were asked if they had experienced sexual violence, and when it occurred. This information was important to include because of the widespread sexual violence in the region and its psychological consequences (Mukwege et al., 2010; Johnson et al., 2010). Measures of other traumatic events were not included.

Maternal Anthropometry: Height, weight, and mid-upper arm circumference (MUAC) were measured by trained ADRA field agents using standard protocols (Lohman, 1988). Body mass index (BMI) was calculated for non-pregnant women. Non-pregnant women were classified as underweight if their BMI was less than 18.5 kg/m². Nutritional status of pregnant women was assessed using MUAC, and pregnant women were classified as underweight if their MUAC was less than 23 cm.

Maternal Diet: Maternal diet was assessed using an open recall method, in which participants were asked to name all of the foods they consumed the previous day. With this technique, the enumerator does not list predetermined food groups to the participant, rather the foods are recorded and later classified into food groups. All foods and ingredients in composite dishes were then classified into one of ten food groups, and the number of groups consumed was summed to generate a dietary diversity score (range 0-10). The food groups were selected based on those utilized in the Minimum Dietary Diversity for Women indicator, designed to reflect micronutrient adequacy of the diets of women of reproductive age (FAO and FHI 360, 2016; Martin-Prével et al., 2015). The food group categories were: 1) starchy staples (grains, white roots, tubers, and plantains); 2) pulses (beans, peas, lentils); 3) nuts and seeds; 4) dairy; 5) meat, poultry, and fish; 6) eggs; 7) dark green leafy vegetables; 8) other vitamin A-rich fruits and vegetables; 9) other vegetables; and 10) other fruit. Questions on maternal diet were included with the maternal mental health questionnaire.

Child Nutritional Status: Weight, height, and MUAC of children enrolled in the study were also measured. Weight-for-age, height-for-age, and weight-for-height z scores were calculated using 2006 WHO Growth Standards (WHO Multicentre Growth Reference

Study Group, 2006). Children with a height-for-age z score < -2 were classified as stunted, and those with a weight-for-age z score of < -2 were classified as underweight. Measurements were taken by trained ADRA field agents using standardized protocols (Lohman et al., 1988).

Child Diet: Children's diet was measured using WHO indicators for infant and young child feeding practices (World Health Organization, 2010). Dietary diversity was assessed by asking mothers whether children consumed any foods from seven food groups the previous day, and a dietary diversity score (range 0-7) was calculated. Child food groups were 1) starchy staples (grains, white roots, tubers, and plantains); 2) legumes and nuts; 3) dairy products (milk, yogurt, cheese); 4) meat, fish, and poultry; 5) eggs; 6) vitamin A-rich fruits and vegetables; and 7) other fruits and vegetables.

Children were classified as achieving minimum dietary diversity if they consumed at least four of the seven food groups the previous day. To assess meal frequency, mothers were asked how many meals or snacks their children consumed the previous day. Children were classified as achieving minimum meal frequency if they consumed 3 meals the previous day for breastfed children and 4 meals on the previous day for non-breastfed children. An additional analysis was conducted with the threshold of 3 meals for non-breastfed children used to classify children as having achieved minimum meal frequency. Minimum acceptable diet (children who have achieved both minimum dietary diversity and meal frequency) was not evaluated due to the low prevalence of children achieving this indicator over the parent study follow-up period (typically $< 5\%$ each survey).

Data Collection Timeline

Table 2.4 displays the activities conducted by the parent study and the sub-study in each year of follow-up. Parent study activities began in 2012 with selection of study sites, enrollment of Jenga Jamaa II beneficiaries and control group members, and the first survey occurred in August 2012. Data collection for the sub-study began in the last year of the parent study, with maternal mental health, maternal diet, and maternal anthropometric data collection concurrent with the September 2015 parent study survey. Maternal weight, MUAC, and diet data were collected a second time during the March 2016 parent study survey. Maternal mental health and all anthropometric measurements were assessed during the March 2016 survey for participants who were who were absent (or their child was absent) during the September 2015 survey. Child diet and anthropometric data were collected as part of the parent study surveys. For Aim 2, child data were used from the same survey period when maternal mental health data were collected (Chapter 4).

Sample Size Considerations

The sample size for Specific Aims 1 and 2 was fixed, as 1,243 households had children enrolled in the parent study, thus 1,243 mother-child pairs were eligible for participation in the sub-study. Power calculations were conducted based on the Specific Aim 2 analysis, which evaluated the association between maternal mental health symptoms and child diet and nutritional status. Based on prior studies in Eastern Congo, it was anticipated that 40% of mothers enrolled would have elevated symptoms of depression (Johnson et al., 2010). Based on 2014 parent study data, 65% of children enrolled were stunted, as measured by height-for-age z score < -2 (Doocy et al., 2014). With α of 0.05 and 80% power ($\beta = 0.2$), this study would require a sample size of at least

393 mother-child pairs to detect an odds ratio of 1.4 for the association between symptoms of maternal mental health problems and child stunting, which is similar to the results reported by other studies (Surkan et al., 2011). Table 2.5 illustrates potential sample sizes according to power and detectable odds ratios. The following formula was used: $N_1 = [Z_{\alpha} + \exp(-\theta^*/4)Z_{\beta}]^2(1+2P\delta)/(P\delta^*)$; where P= the estimated prevalence of stunting, θ^* = the log odds ratio, and $\delta = [1+(1+\theta^*)\exp(5\theta^*/4)][1+\exp(-\theta^*/4)]^{-1}$ (Hsieh, 1989).

Qualitative Research Methods

The present study uses a mixed methods approach with an explanatory sequential design, with the qualitative research (Specific Aim 3) designed to explain the findings of the quantitative research (Aims 1 & 2) (Creswell, 2014). Maternal mental health was assessed quantitatively from data obtained during the September 2015 survey, and the results of the quantitative analysis were used to sample mothers with a range of symptom severity to participate in the qualitative research, which occurred during the March 2016 parent study survey.

Specific Aim 3 used in-depth interviews and focus group discussion to gain an understanding from the participants' perspectives about how psychological distress impairs maternal functioning and child feeding practices. Qualitative research methods are important for identifying behaviors and processes that may underlie an association, thus this study was designed with the idea that the qualitative research may help identify the specific care and feeding practices and contextual factors that underpin an association between maternal mental health and maternal and child nutrition found in the first two quantitative aims.

Cumulative mean item scores on the mental health questionnaire, including HSCL-25 and HTQ items and local relevant symptoms, were calculated. A purposive sampling strategy was used, in which a list of participants with both high and low levels of mental health symptoms (mean item scores in the upper and lower quartiles, respectively) were selected and then stratified by territory and intervention/control group. The purpose of sampling participants with both high and low levels of mental health symptoms was to understand whether the problems reported by highly symptomatic mothers were unique, or whether they affected all mothers regardless of mental health symptomatology.

In-depth interviews (IDIs) were conducted using a guide developed with input from local research assistants and experts in mental health research. The guide included two vignettes that described women with depressive symptoms and post-traumatic stress-like symptoms, which were read aloud by facilitators. The vignettes were designed to portray scenarios relatable to study participants, and were informed by the student investigators prior travel to the study sites and input from local research assistants. Guides were developed in English and translated to Swahili by ADRA research assistants. The study team reviewed the guides collectively and edited them for clarity prior to data collection. Participants were asked to describe their reactions to the vignettes, and to describe women in their community who have similar problems. Participants were asked about the perceptions on how psychological distress affects functioning, in particular the care and feeding of their children. A total of 20 IDIs were conducted.

Five key informant interviews (KII) with local project staff and health workers were conducted to understand how maternal mental health affects child feeding practices from their perspective, and to triangulate IDI and FGD findings. The KII guide did not include the vignettes, but KII participants were asked to describe their observations on problems facing women in the communities they served, particularly how psychosocial factors affected women's ability to care for their children.

FGDs were held with study participants who had not participated in IDIs, with the purpose of triangulating the results of the IDI findings. The FGD guide employed the same vignettes as the IDI guide, but did not ask about participants' personal experiences for reasons of confidentiality. Rather, it encouraged participants to discuss how stressors and psychological distress affected women in their community. One FGD was held in Uvira territory with seven participants, and one was held in Fizi territory with eight participants, for a total of 15 FGD participants. Sites were selected based on logistical considerations, so that FGD participants would not have to travel too far. Once the two sites were selected for the FGDs, ADRA field agents contacted potential participants with varying mental health symptomatology in advance to gauge their interest and schedule the meetings around the participants' schedules and availability. Efforts were made to balance the number of participants from each intervention group in each focus group.

Three female ADRA field agents who worked in health/nutrition and gender programming were present at each IDI and FG; two facilitated the discussion and one took notes. These staff members received training on qualitative research methods, interview techniques, and research ethics prior to data collection. Interviews and FGDs took place at data collection sites for the parent study, but were held in private areas away

from other study participants and community members due to the sensitive nature of the topics. KIIs were conducted in French by the student investigator, with the exception of one KII which required French-Swahili translation assistance from an ADRA staff member. Interviews and focus group discussions were audio-recorded with a digital audio recorder. After each IDI and FGD, the student investigator reviewed the notes with the facilitators, and provided feedback as well as flagged additional themes that could be followed up on during subsequent interviews.

Interviews and FGDs were transcribed in Swahili by local research assistants, and then translated to French. The analysis was conducted in French by the student investigator using an approach adapted from Grounded Theory, in which themes were coded as they emerged in the data, rather than by following an *a priori* codebook (Glaser et al., 1968; Charmaz, 2006). Codes were then grouped according to topic, and the most salient themes and rich quotes were identified and translated to English.

A mixed methods approach is useful for addressing this research question, as certain aspects of a problem often may be missed by focusing on only quantitative or qualitative methods. Quantitative methods are often used to generalize qualitative findings, and qualitative methods can help interpret quantitative results (Pluye & Hong, 2014). Mixed methods research provides statistically testable results, but with greater understanding of the contextual factors and pathways identified from the qualitative component. This is especially important for research that examines diet and feeding practices, in which human behavior and a variety of socio-cultural factors may play a role (Harris et al., 2009). Mixed methods research is also important for informing

intervention design, as often only knowing if there is an association between two factors is not enough to design an intervention (Creswell et al., 2004).

Ethical Considerations

The Jenga Jamaa II parent study was reviewed and approved by the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health, and the all components of the dissertation received additional IRB approval. The study team received training about mental health research ethics, especially the importance of sensitivity during the interviews, maintaining confidentiality, and the voluntary nature of participation. The mental health questionnaire did not include questions on suicidality (one question on suicidal ideation was excluded from the Hopkins Symptoms Checklist-25) and is not designed to diagnose participants with mental health disorders. The primary burden to the participants was time, although to the extent that participants were asked to talk about stressful events in their lives, the interviews may have been stressful. However, the opportunity to talk about their experiences may have been positive for some participants. The risk of breach of confidentiality was minimized by onsite supervision by the student investigator and study research assistants (ADRA staff members not involved in program activities), and data were de-identified and tracked only by household identification number.

Participants received a bar of soap or a pair of plastic sandals (worth approximately \$1) for participation in parent-study data collection activities. Children identified as undernourished during the anthropometric assessment were referred to nutrition programs or health centers. When enumerators interviewed participants who they judged to be experiencing distress based on their responses to the questionnaire, they

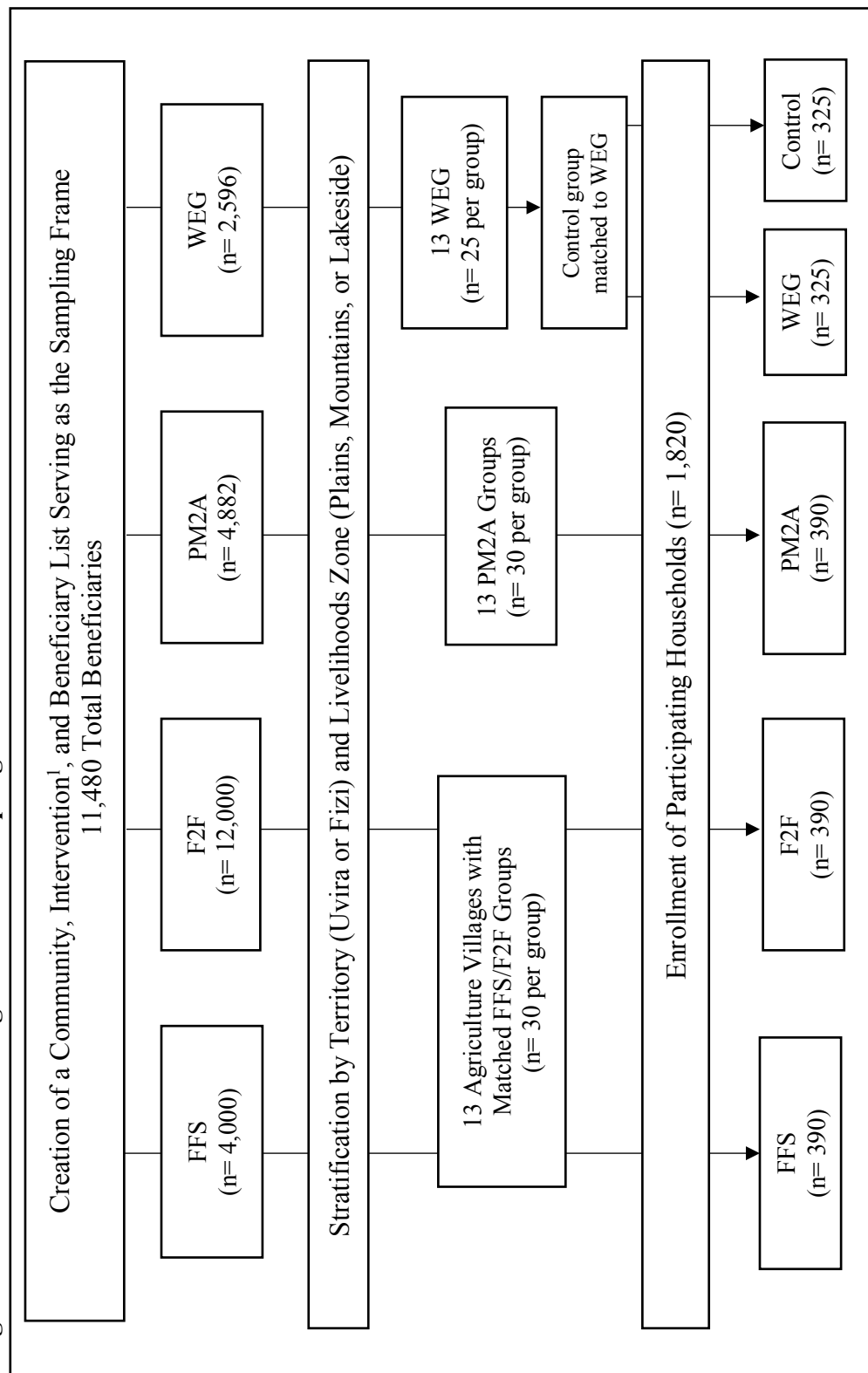
referred them to a health center or counselling service where available. Participants classified as having high levels of psychological distress were scheduled to receive a follow-up visit from an ADRA field agent and additional referrals as necessary.

2.4 SUMMARY

This chapter presented an overview of the existing literature on associations between maternal mental health, maternal and child diet and nutritional status, and infant and young child feeding practices, and highlighted the need for further research in this area. Studies have shown strong associations between maternal mental health and child undernutrition in South Asia, but the evidence has been mixed in sub-Saharan Africa. Few studies have evaluated if maternal mental health is related to maternal diet and nutritional status in developing countries. Additionally, this topic has not been explored in a post-conflict, humanitarian setting, where risk factors for both mental health problems and undernutrition may be elevated.

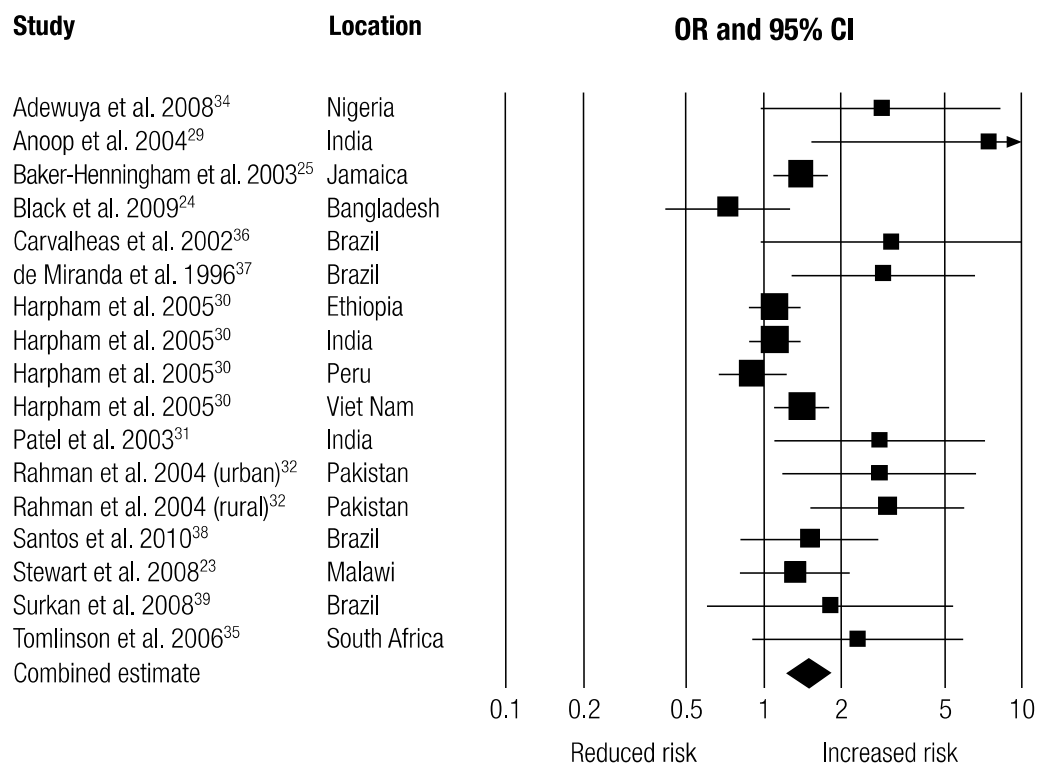
The mixed methods study design is valuable in that the qualitative research provides a greater contextual understanding of results found in the quantitative component. The research objectives and hypotheses were outlined, and a description of the parent study and key components of the sub-study were provided. Chapters 3, 4, and 5 will explore each specific aim in detail. Chapter 3 examines relations between maternal mental health, maternal diet, and maternal nutritional status. Chapter 4 examines relations between maternal mental health, child diet, and child nutritional status. Chapter 5 describes mothers' perspectives on how maternal mental health affects infant and young child feeding practices, based on the results of the qualitative research. The methods, analyses, results, and conclusions will be presented in detail for each chapter.

Figure 2.1: Overview of Jenga Jamaa II Sampling and Enrollment



¹Intervention Groups: WEG: Women's Empowerment Groups, PM2A: Prevention of Malnutrition in Children under 2 Approach, FFS: Farmer Field Schools, F2F: Farmer to Farmer.

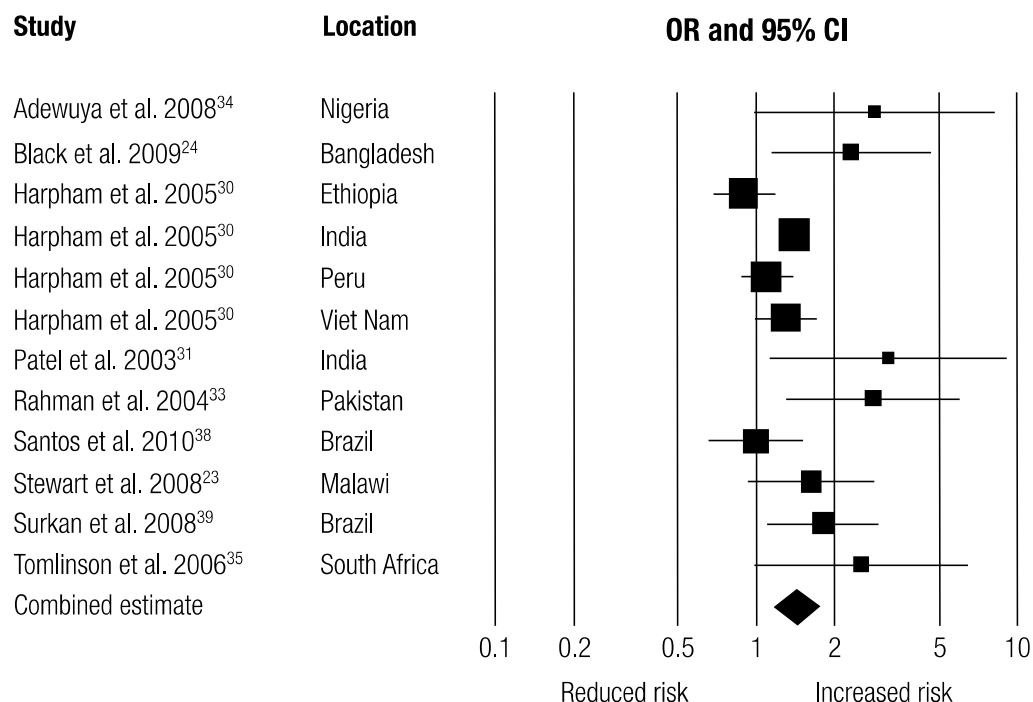
Figure 2.2: Effect of maternal depression on child underweight reported in studies from developing countries included in meta-analysis, 1996-2010 (Surkan et al., 2011)



CI, confidence interval; OR, odds ratio.

Note: The position of the square indicates the OR for the relationship between maternal depression and child underweight for the study and its size is proportional to the weight of that study in the meta-analysis. The length of the line represents the 95% CI for the OR. The diamond shape indicates the pooled OR for all studies included in the meta-analysis.

Figure 2.3: Effect of maternal depression on child stunting reported in studies from developing countries included in meta-analysis, 1996-2010 (Surkan et al., 2011)



CI, confidence interval; OR, odds ratio.

Note: The position of the square indicates the OR for the relationship between maternal depression and child stunting for the study and its size is proportional to the weight of that study in the meta-analysis. The length of the line represents the 95% CI for the OR. The diamond shape indicates the pooled OR for all studies included in the meta-analysis.

Figure 2.4: Conceptual Framework for Maternal Mental Health and Maternal and Child Nutrition

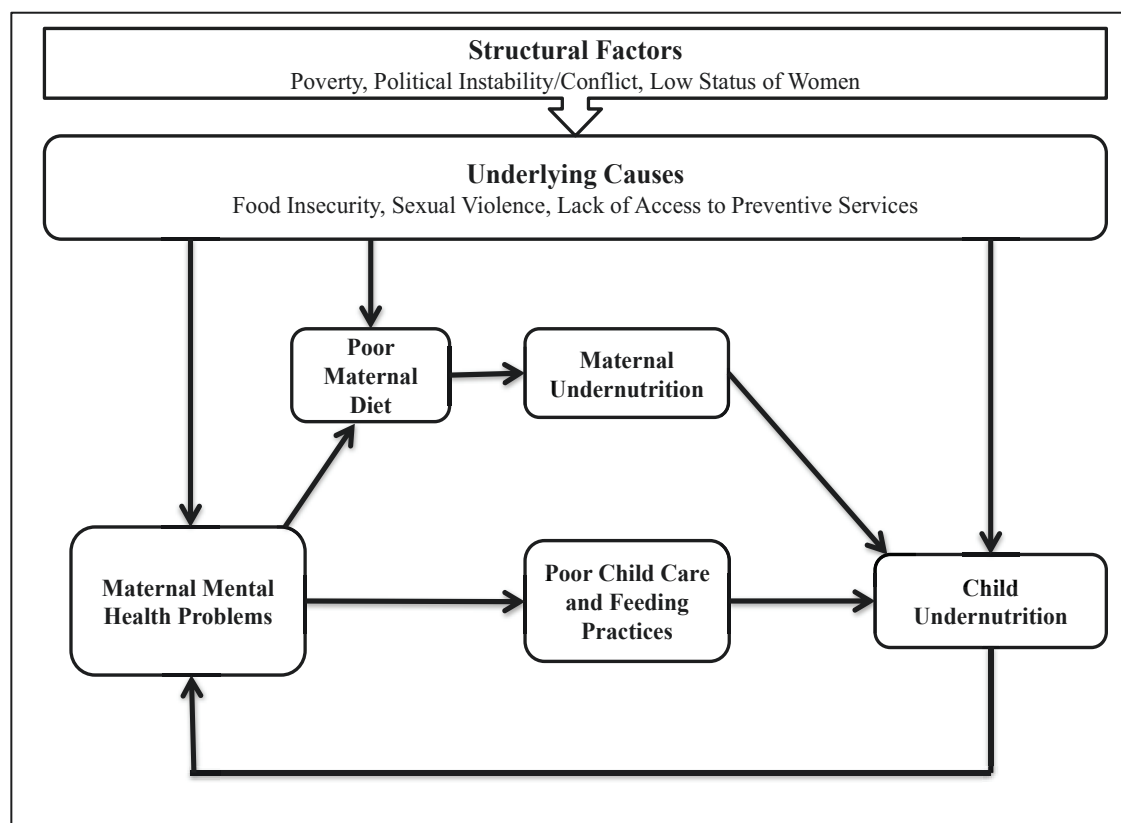


Table 2.1: Number of Children Enrolled per Jenga Jamaa II Study Group¹ over Time (n= 1,385)

	WEG	PM2A	FFS	F2F	Control
August 2012	205	347	190	194	235
March 2013	27	50	22	24	28
September 2013	11	11	10	7	13
March 2014	0	1	4	4	0
Total	245	409	226	229	276

¹WEG: Women's Empowerment Group, PM2A: Prevention of Malnutrition in Children under 2 Approach, FFS: Farmer Field Schools, F2F: Farmer-to-Farmer

Table 2.2: Key Variables		
Background and Demographic Characteristics		
Variable	Source	Responses
Maternal education	Mental Health Questionnaire	0: no education, reference 1: some primary school 2: some secondary school
Household size	Parent study- Household Survey	continuous
Household food security	Parent study- Household Survey	0: reference 1: severely food insecurity
Maternal age	Mental Health Questionnaire	continuous
Marital status	Mental Health Questionnaire	0: reference 1: married
Current pregnancy	Mental Health Questionnaire	0: reference 1: pregnant
Parity	Mental Health Questionnaire	continuous
Child death	Mental Health Questionnaire	0: reference 1: child death
Intervention Group	Parent study- Household Survey	0: WEG, reference 1: PM2A 2: FFS 3: F2F 4: Control
Territory	Parent study- Household Survey	0: Uvira, reference 1: Fizi
Livelihoods zone	Parent study- Household Survey	0: Mountains, reference 1: Plains 2: Lakeside
Maternal Mental Health		
Variable	Source	Responses
HSCL-25 mean item score	Mental Health Questionnaire	continuous
HTQ mean item score	Mental Health Questionnaire	continuous
High Psychological Distress	Mental Health Questionnaire	0: reference 1: high distress
Maternal Dependent Variables		
Variable	Source	Responses
Underweight	Maternal Anthropometric Assessment	0: reference 1: underweight
BMI	Maternal Anthropometric Assessment	continuous
Dietary Diversity Score	Mental Health Questionnaire	continuous

Child Dependent Variables		
Variable	Source	Responses
Height-for-age z score	Parent study- Child Anthropometric Assessment	continuous
Weight-for-age z score	Parent study- Child Anthropometric Assessment	continuous
Weight-for-height z score	Parent study- Child Anthropometric Assessment	continuous
Stunting	Parent study- Child Anthropometric Assessment	0: reference 1: stunting
Underweight	Parent study- Child Anthropometric Assessment	0: reference 1: underweight
Dietary diversity Score	Parent study- Child Questionnaire	continuous
Meal/snack frequency	Parent study- Child Questionnaire	continuous
Minimum Dietary Diversity	Parent study- Child Questionnaire	0: reference 1: achieved minimum dietary diversity
Minimum Meal Frequency	Parent study- Child Questionnaire	1: achieved minimum meal frequency

Table 2.3: Mental Health Questionnaire Items

HSCL-25 Items	HTQ Items	Other Locally-Relevant Items**
Depression Subscale	Feeling no interest in things/less interest in daily activities *	Being afraid to be infected by disease
Feeling low in energy, slowed down	Recurrent thoughts or memories of the most hurtful or terrifying events*	Feeling badly treated by family members
Blaming self for things*	Feeling as though the hurtful or terrifying event is happening again	Feeling badly treated by community members
Crying easily*	Recurrent nightmares (about the event)	Feeling shame
Loss of sexual interest or pleasure	Feeling detached or withdrawn from others*	Feeling rejected by everybody
Poor appetite*	Unable to feel emotions	Feeling stigma
Difficulty falling asleep, staying asleep*	Feeling jumpy, easily startled	Thinking too much about what happened to you
Feeling hopeless about the future*	Difficulty concentrating	Thinking too much about other things that upset you
Feeling sad*	Feeling on guard	Wanting to avoid other people or hide
Feeling lonely*	Feeling irritable or having outbursts of anger	Too many thoughts
Feeling of being trapped or caught	Avoiding activities that remind of the traumatic or hurtful event*	To be cold/shy
Worrying too much about things*	Inability to remember parts of the most traumatic or hurtful events	Lacking peace
Feeling no interest in things/less interest in daily activities *	Feeling as if you don't have a future*	Anger in the heart
Feeling everything is effort	Avoiding thoughts of feelings associated with the traumatic or hurtful events	Inward wounds

Feelings of worthlessness- no value*	Sudden emotional or physical reaction when reminded of most hurtful/traumatic events
Anxiety Subscale	Feeling guilty
Feeling fearful*	
Faintness, dizziness or weakness*	
Nervousness or shakiness inside	
Heart pounding or racing*	
Trembling	
Feeling tense/ keyed up*	
Headaches*	
Spells of terror/panic*	
Feeling restless, can't sit still	

*Locally-relevant symptoms identified in qualitative research (Bass et al., 2013)

**Locally-relevant symptoms research that were not represented by HSCL-25 and HTQ items

Table 2.4: Timeline of Activities for Parent Study and Sub-Study

Year	Month	Parent-Study Activities	Sub-Study Activities
2012	March	- Jenga Jamaa II Project Activities Begin	
	July	- Study Site Identification	
	August	- Enrollment and Survey 1	
2013	March	- Survey 2	
	September	- Survey 3	
2014	March	- Survey 4	
	September	- Survey 5	
2015	March	- Survey 6	
	September	- Survey 7	- Maternal MH questionnaire - Maternal diet recall (1) - Maternal height - Maternal weight (1) - Maternal MUAC (1)
2016	March	- Survey 8	- Maternal diet recall (2) - Maternal weight (2) - Maternal MUAC (2)
			- Maternal MH and anthropometry assessed for participants who were absent during Survey 7
			- Interviews and focus groups conducted for Aim 3

Table 2.5: Sample Size Calculations for Univariate Logistic Regression

Detectable Odds Ratio	Power				
	75%	80%	85%	90%	95%
1.05	1662	1877	2146	2508	3089
1.1	903	1019	1163	1358	1671
1.2	528	594	678	790	969
1.3	407	458	521	606	742
1.4	349	393	446	518	634

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CHAPTER 3: MATERNAL MENTAL HEALTH AND MATERNAL DIET AND NUTRITIONAL STATUS

ABSTRACT

In developing countries, maternal mental health problems have been linked to sub-optimal child feeding practices and child underweight and stunting, but little is known about how maternal mental health is associated with mothers' own diet and nutritional status. The present study investigated the association between maternal mental health symptoms and maternal diet and nutritional status. Participants were 828 mothers of young children enrolled in a larger study evaluating Jenga Jamaa II, a USAID-funded food assistance program in South Kivu, Democratic Republic of Congo.

Data were collected via a questionnaire that included items from the Hopkins Symptom Checklist-25 (HSCL-25), measuring symptoms of depression and anxiety, and the Harvard Trauma Questionnaire (HTQ) measuring post-traumatic stress disorder symptoms. The questionnaire utilized a 4-point Likert scale, with mean item scores ranging from 1-4. A variable for high psychological distress was constructed to identify participants whose mean item scores were in the upper quartile of both measures. Maternal diet was measured using an open recall, and foods consumed in the previous day were classified into one of ten different food groups. Body mass index of non-pregnant participants was assessed, as well as underweight status of all participants, using mid-upper arm circumference to classify underweight pregnant women. Demographic and background variables were collected in the same questionnaire.

Bivariate and multivariate regression analyses were conducted to evaluate the association between each mental health variable and each dependent variable (dietary

diversity score, BMI, and underweight). Multivariate analyses adjusted for intervention group, education level, age, self-reported health status, number of children, livelihoods zone, and living in territory of origin.

Higher levels of mental health symptoms were positively and significantly associated with higher dietary diversity in adjusted analyses (HSCL-25: β : 0.22, $p=0.002$, HTQ: β : 0.13, $p=0.017$, High Distress: β : 0.27, $p=0.003$). Mental health symptoms were not significantly associated with BMI or underweight. Overall, maternal mental health and dietary diversity were poor, indicating a need for greater focus on both maternal mental health and maternal nutrition in maternal and child health programs.

3.1 INTRODUCTION

Maternal mental health problems are common morbidities in the perinatal period, and are associated with a wide range of adverse outcomes for mothers and children (Howard et al., 2014). Most research has focused on postpartum depressive symptoms, with less known about anxiety and post-traumatic stress disorder. It is estimated that in low and middle-income countries, about 15% of pregnant women experience symptoms of mental health problems in the antenatal period, and 20% experience symptoms in the postpartum period (Fisher et al., 2012). Symptoms of maternal mental health problems are associated with increased risk of preterm delivery, child stunting and underweight, infectious disease incidence, insecure maternal-infant attachment, and emotional and behavioral difficulties in childhood (Grigoriadis et al., 2013; Surkan et al., 2011; Rahman et al., 2007; Atkinson et al., 2000; Velders et al., 2011). Less is known about the mental health of mothers beyond the postpartum period, although globally women have twice the risk of experiencing major depressive episodes compared to men (Kessler & Bromet, 2013).

In high-income countries, mental health problems among mothers are associated with higher BMI and increased risk for overweight and obesity (Lacoursiere et al., 2006; Carter et al., 2000). This relation may be explained by increased desire for food and preference for energy-dense foods in response to stress (Dallman, 2010; Torres & Nowson, 2007). One study found that distressed pregnant women consumed more macronutrients and fewer micronutrients (Hurley et al., 2005), and depressive symptoms in adults are associated with decreased consumption of fruits and vegetables and

increased consumption of energy-dense sweet foods (Kontinen, 2010; Jeffery et al., 2009). Several studies, however, have found that mental health problems are associated with both underweight and overweight/obesity in the same population (Zhao et al., 2009; de Wit et al., 2009; Martin-Rodriguez et al., 2016). This finding is consistent with the *Diagnostic and Statistical Manual of Mental Disorders* (2013) 5th ed. diagnostic criteria, as changes in appetite (decrease or increase), weight loss or weight gain, and fatigue or loss of energy (potentially related to decreased physical activity) are all symptom criteria for major depression (American Psychiatric Association, 2013). In sub-Saharan Africa, symptoms of mental health problems are associated with food insecurity, yet there has been little research on mental health and the diet and nutritional status of adult women (Dewing et al., 2013; Hadley & Patil, 2008; Sorsdahl et al., 2011).

The objective of the present analysis is to evaluate the association between symptoms of mental health problems and the diet and nutritional status of mothers of young children in Uvira and Fizi territories, South Kivu province. We hypothesized that higher symptoms of mental health problems are associated with lower dietary diversity, lower BMI, and increased odds of maternal underweight, based on the high prevalence of food insecurity and lack of evidence for eating as a stress response in this context.

3.2 METHODS

Setting and Participants

The Democratic Republic of Congo was the site of an armed conflict lasting from 1998-2003, resulting in an estimated 3.9 million deaths (Coghlan et al., 2006). Fighting and instability have continued in its Eastern provinces, and local and foreign armed groups often use sexual violence as a strategy to terrorize the population and destroy

community ties (Mukwege et al., 2010). The mental health and nutritional status of the population is poor, with one survey in North and South Kivu reporting that 50% of the population had symptom criteria for PTSD and 40% for major depression (Johnson et al., 2010). According to the most recent DHS, 7% of women in South Kivu are underweight and 22% are anemic (*DRC DHS*, 2014).

To address the high prevalence of food insecurity and undernutrition in South Kivu, the USAID Office of Food for Peace provided funding for a multi-year food assistance program called Jenga Jamaa II, which was implemented by the non-governmental organizations Adventist Development and Relief Agency (ADRA) and World Vision International. Jenga Jamaa II program activities included Women's Empowerment Groups (WEG), Farmer Field Schools (FFS), Farmer-to-Farmer (F2F), and the Prevention of Malnutrition in Children under Two Approach (PM2A), with the goal of improving household income and food security as well as child nutritional status (Mathys & Remancus, 2010).

The present study is situated within a larger study. The parent study used a quasi-experimental design to evaluate the effectiveness of Jenga Jamaa II interventions compared to a control group. The study area was in Fizi and Uvira territories, which were the areas where ADRA was responsible for program implementation. Villages were stratified by territory and livelihoods zone (mountains, plains, and lakeside) and then selected for enrollment based on their relative proximity to each other and perceived similarity according to project staff. Only villages that received one of the interventions (as opposed to two or more) were enrolled.

The parent study enrolled 1,820 households, with 1,387 children under five years of age enrolled from 1,243 of the households. Participants were beneficiaries of one of the Jenga Jamaa II intervention groups or members of the control group. The control group members were women from WEG communities who were not participating in any intervention. Parent study surveys were conducted every six months throughout the period of the project. Participants in the parent study who were mothers of children five years of age or under were eligible for participation in the present study.

Procedure

Data were collected in the last year of the parent study, during two surveys conducted in September 2015 and March 2016. A questionnaire measuring maternal mental health and background/demographic characteristics was implemented during the first data collection period and not repeated during the second data collection period for participants who were present for the earlier period. This questionnaire, along with questions on maternal diet, was added to the Jenga Jamaa II Child Questionnaire, which collected data about infant and young child feeding practices from mothers of children under five years of age enrolled in the parent study. Data were collected electronically using the mobile data collection application Magpi and Android tablets provided by ADRA (DataDyne, 2015). Height was measured only once, and weight measurements and dietary data were collected at both data collection periods

The Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health approved all data collection instruments and procedures. At every data collection encounter for the parent study, study staff obtained oral consent in Swahili, the predominant local language, and participants were reminded that they could decline to

participate at any time. Additional oral consent was requested for participation in the sub-study, in which the mental health questionnaire was described as well as the potential risks and benefits of participation. ADRA field agents who served as study enumerators received training on the questionnaire and on research ethics prior to data collection.

Measures

Maternal Mental Health

Maternal mental health was assessed using a questionnaire adapted from the DRC Gender Based Violence (GBV) Psychosocial Evaluation, developed for a study previously conducted in South Kivu (Bass et al., 2013). Based on the findings of qualitative studies in three linguistically different communities to identify mental health problems of sexual-violence survivors, the authors selected the Hopkins Symptom Checklist (HSCL-25) to assess depression symptoms (15 items) and anxiety symptoms (10 items), and the Harvard Trauma Questionnaire (HTQ) to assess PTSD symptoms (16 items) (Derogatis et al., 1974; Mollica et al., 1992). For the purposes of the present study, one item on suicidality was dropped from the HSCL-25 due to ethical considerations. Trauma exposure was assessed by one question only that addressed sexual violence exposure; it was considered important in this context due to the endemic sexual violence in the region (Mukwege et al., 2010). Participants were asked whether they had experienced sexual violence, and if so, how many years ago they had the experience (in the last year, in the last five years, or more than five years ago).

For each scale, participants rated the frequency of each symptom in the prior four weeks on a four-point Likert scale. Participants' mean item HSCL-25 score and mean item HTQ score were assessed as independent variables, with a possible range of one to

four. A binary variable for participants with high psychological distress was created for those having mean item scores in the upper quartile of each measure (≥ 2.6 for the HSCL-25 and ≥ 2.5 for the HTQ). A mean item score ≥ 1.75 has been used in other conflict-affected populations to identify those with significant emotional distress using the HSCL-25 scale, and this cut-off has also been used to indicate probable depression and probable anxiety in the HSCL-25 subscales for depression and anxiety (Mollica et al., 1987; Hadley et al., 2008; Foss et al., 2004). HTQ mean item scores ≥ 2.5 have been found to maximize classification accuracy for probable PTSD among other trauma-affected populations (Mollica et al., 1992; Kleijn et al., 2001). However, several studies have empirically validated HSCL-25 cut-off points against classification with a structured clinical interview; among HIV positive pregnant women in Tanzania a mean item HSCL-25 score of 1.06 was found to be the optimum cut-off point (Kaaya et al., 2002). In rural Afghanistan, a cut-off point of 2.0 was found to maximize the area under the curve (sensitivity 0.69, specificity 0.67), however the optimal cut-off point for women was 2.25 and for men was 1.5 (Ventevogel et al., 2007). However, no criterion validity studies have been conducted in Eastern DR Congo for these measures, thus variables for probable depression/anxiety and PTSD classification defined by cut-off points of 1.75 and 2.5, respectively, were not explored as independent variables in the primary analyses. Secondary analyses conducted with mental health variables constructed based on these cut-off points are presented in Appendix Table 1.1.

The Hopkins Symptom Checklist is frequently used in a variety of cultural settings (Mollica et al., 1987; Hadley et al., 2008; Lee et al., 2008; Rieder & Elbert, 2013). An advantage of the HSCL-25 is that people who are not trained mental health

workers can be easily instructed to use the tool, but it is not designed to differentiate between mental disorders and reactions to environmental stress (Ventevogel et al., 2007). The validity of a Swahili version of the scale has been evaluated in a sample of Tanzanian women using content and construct validation methods (Lee et al., 2008), and it has been used previously to assess maternal depressive symptoms among Congolese refugees in the United States (Foss et al., 2004). The validity of the Harvard Trauma Questionnaire has been assessed in multiple settings and is often used among populations who have experienced conflict and displacement, such as refugees (Mollica et al., 1992; Mollica et al., 1999; Hollifield et al., 2002; Rasmussen et al., 2015).

Test-retest and inter-rater reliability of HSCL-25 and HTQ mean item scores were examined using Pearson product moment correlation coefficients from a pilot test of the mental health questionnaire conducted prior to the survey, and internal consistency reliability of mental health measures was assessed after data collection was complete using Cronbach's coefficient alpha (Cronbach, 1951). The pilot test involved 100 participants; of these, 29 participants were given the questionnaire twice by two different enumerators over the course of several days in order to evaluate test-retest and inter-rater reliability. The correlation coefficients for the two time points and raters were 0.41 ($r(27), p=0.03$) for the HSCL-25 scale, and 0.50 ($r(27), p=0.005$) for the HTQ scale. With data from the complete sample, the HSCL-25 items had a scale reliability coefficient of 0.92 and the HTQ items a scale reliability coefficient of 0.91. A test-retest reliability coefficient of at least 0.75 is usually considered acceptable for clinical purposes (Vaz et al., 2013). The anxiety and depression subscales of the HSCL-25 had a

correlation coefficient of 0.72 ($r(826)$, $p < 0.001$). The correlation coefficient of the HSCL-25 and HTQ was 0.82 ($r(826)$, $p < 0.001$).

Maternal Anthropometry

Maternal nutritional status was assessed through anthropometric measures. Maternal height, weight, and mid-upper arm circumference (MUAC) were measured by trained ADRA field agents using standard protocols (Lohman et al., 1988). Height was measured once, and weight and MUAC were measured during both data collection periods (for participants present at both). Body mass index (BMI) was calculated for non-pregnant participants, and MUAC was used to assess nutritional status of pregnant participants. Weight was averaged for the two time points when participants were present at both surveys, or a sole weight measure was used for participants who were only present at one survey. Pregnant mothers having a MUAC < 23 cm were classified as underweight, and non-pregnant mothers having a BMI < 18.5 kg/m² were classified as underweight (Ververs et al., 2013). Participants were measured using a Model 1582 Tanita Mommy and Baby Infant Scale (Arlington Heights, IL) and a Shorr Productions (Olney, MD) height board.

Maternal Dietary Diversity

Maternal diet was assessed with an open recall method, which is a qualitative assessment similar in approach to a 24-hour recall but without portion size estimation (FAO and FHI 360, 2016). Enumerators did not read foods from a predetermined list; rather they asked participants to list all foods consumed the previous day and night. When composite dishes were mentioned, they asked for a list of ingredients and probed for additional items. All of the food items were recorded in Swahili, and then translated

to English and classified into one of ten possible food groups: 1) starchy staples (grains, white roots, tubers, and plantains); 2) pulses (beans, peas, lentils); 3) nuts and seeds; 4) dairy; 5) meat, poultry, and fish; 6) eggs; 7) dark green leafy vegetables; 8) other vitamin A-rich fruits and vegetables; 9) other vegetables; and 10) other fruit. The number of food groups consumed was summed to create a dietary diversity score, with a possible range of 0-10 (FAO and FHI 360, 2016).

Maternal diet data were collected at two time points and an average score was calculated, in order to reduce variability of women's diet across seasons. The food groups were selected as they are used to construct the Minimum Dietary Diversity Indicator for Women (MDD-W), which was constructed based on its ability to predict micronutrient adequacy for women 15-49 years of age consuming at least five of the ten food groups (Martin-Prével et al., 2015).

Demographic and Socioeconomic Measures

The mental health questionnaire included a section on background and demographic characteristics: mother's age, years of education obtained, ethnic group, and marital status. Mothers were also asked whether they were currently living in their territory of origin. Education was recoded as a categorical variable with three categories: no education, completing at least some primary school, and completing at least some secondary school or higher education. Information on current pregnancy status was collected in addition to how many children each mother was responsible for caring for. Additional questions were included during the second data collection period to assess how many children each mother gave birth to, and how many were still alive. An

indicator was then constructed for a child death. Finally, mothers were asked to assess their physical health, using a scale ranging from excellent to poor.

Household-level data, including household size, income in the past month, and food insecurity, were collected as part of the Jenga Jamaa II survey questionnaire. Food insecurity was measured using the Household Food Insecurity Access Scale (HFIAS), a questionnaire that measures food access using a Likert scale. Responses are summed with a possible range of 0-27, with lower scores indicating less food insecurity (UN Food and Agriculture Organization, 2010; Coates, 2007). Using the HFIAS, households were classified in categories ranging from food secure to severely food insecure. This measure has been found to distinguish food secure households from food insecure households in different cultural contexts (Coates et al., 2006; Coates, 2007). Participants were also asked their income in the past month. Household income was not included in the final analysis because it was not reflective of socioeconomic status; it may have represented the sale of assets due to hardship or food insecurity.

Indicator variables for intervention groups were created for the four Jenga Jamaa II program interventions (WEG, PM2A, FFS, F2F) along with the control group.

Indicator variables for geographic region (Uvira or Fizi territory) and livelihoods zone (plains, mountains, or lakeside) were also included.

Statistical Analysis

Distributions of continuous variables and frequencies of categorical variables were explored and outlying values were identified. Associations between background characteristics and independent and dependent variables were assessed to identify potential confounding variables. The three dependent variables assessed were dietary

diversity, BMI, and underweight. Dietary diversity score was continuous variable. BMI was continuous for non-pregnant participants. Underweight was constructed as a binary variable, and included pregnant participants for which underweight was assessed using MUAC (< 23 cm) and non-pregnant participants for which underweight was assessed using BMI (< 18.5 kg/m²). Independent variables for maternal mental health were mean item HSCL-25 score (measuring depression and anxiety), mean item HTQ score (measuring PTSD), and a binary variable for high psychological distress. Separate analyses were conducted for each of the three independent variables due to multicollinearity.

Bivariate regression analyses between each dependent and independent variable were conducted, followed by multivariate linear and logistic regression analyses controlling for potential confounding variables. A sensitivity analysis was conducted to test whether the association between maternal mental health and underweight differed when excluding pregnant women, in the event that the different means of classifying pregnant and non-pregnant women's underweight status affected the results.

3.3 RESULTS

Participant Characteristics

Demographic and background characteristics of the sample are presented in Table 3.1. The mean age of the participants was 29.6 years, and 90.1% were married. About one-third of participants (31.7%) had never attended school, 48.7% had some primary school education, and 19.7% had at least some secondary school education. Most were from the Mubembe (42.4%) or Mufuliro (47.9%) ethnic groups, and most characterized themselves as having poor (26.9%), average (36.2%), or good health (32.8%), with very

few reporting excellent or very good health (4.1%). The participants had on average five children to care for (range: 1-11), and 28.9% had at least one child that died. About 20% reported they were pregnant at the time of the survey.

Over half of participants (53.1%) were living in Uvira territory and 46.5% in Fizi territory. About seventy-five per cent reported currently living in their territory of origin. Most participants (55.4%) lived in the plains livelihoods zone, followed by 30.6% living near Lake Tanganyika and the rest (13.7%) living in mountainous areas in Uvira or Fizi. One-third of participants (34.4%) were in the PM2A intervention group, and 18.4% were in WEG. There were fewer participants from the two agriculture intervention groups, FFS (14.3%) and F2F (13.6%). Control group members represented 19.3% of participants. The average household size of participants was 7.8 people. Median household income in the previous month was 22,500 Congolese francs (approximately \$23). The majority of households (67.8%) were classified as severely food insecure according to the Household Food Insecurity Access Scale.

Maternal Mental Health

Data on maternal mental health was available from 878 mothers present during one of the data collection periods. Of these, 40 did not have children registered in the study and were excluded from the analysis. Data from four additional respondents were excluded, as they were not the biological mother of the child enrolled in the study. Six participants did not have data recorded for maternal diet or anthropometry and were excluded, leaving a total of 828 participants included in the analysis. Descriptive statistics for independent and dependent variables are presented in Table 3.2. Participants' average mean item scores on the Hopkins Symptom Checklist (HSCL-25)

were 2.30 and 2.13 on the Harvard Trauma Questionnaire (HTQ). A total of 686 (82.9%) of participants had mean item scores ≥ 1.75 on the HSCL-25, and 496 (59.9%) had mean item scores ≥ 2.5 on the HTQ; these cut-off points have been used to identify clinically relevant symptoms in other conflict-affected populations but have not been validated in Eastern DR Congo (Mollica et al., 1987; Mollica et al., 1992). There were 684 (82.6%) participants with scores above 1.75 on the HSCL-25 depression subscale, and 620 with scores above the same threshold on the anxiety subscale (74.9%). There were 165 participants (19.9%) whose mean item scores were in the upper quartile of both measures and considered to have high psychological distress.

Forty-four (5.3%) of participants reported experiencing sexual violence, of which nine (17.7%) reported experiencing it in the last six months, ten (19.6%) in the last year, seven (13.7%) in the last five years, and 25 (49%) more than five years ago. HTQ score did not vary by sexual violence exposure, with an average mean score of 2.13 for those that did not report experiencing sexual violence, and an average mean score of 2.16 for those that did ($p=0.753$). Mean HSCL-25 score was slightly higher for those reporting experiencing sexual violence (2.39) compared to those who did not (2.29), but this difference was not statistically significant ($p=0.324$). It was not included as a variable in the final analysis since mental health symptoms did not vary by sexual violence exposure.

Higher HSCL-25 and HTQ mean item scores, indicating greater psychological distress, were positively and significantly associated with household size, maternal age, and number of children. Having at least one child death was associated with higher HTQ score. Mean item scores were negatively associated with currently living in one's territory of origin, having completed at least some secondary school, and having average,

good, or very/excellent health. The Control group had significantly lower mean item HSCL-25 compared to WEG, and both Control and F2F groups had significantly lower mean item HTQ scores. High psychological distress was positively associated with number of children, and negatively associated with living in the plains and lakeside livelihoods zone compared to mountains, living in one's territory of origin, having average, good, or very good excellent health, and being in the Control group.

Maternal Anthropometry

Anthropometric data were available from 782 (94.4%) participants, and their descriptive statistics are displayed in Table 3.2. Mean body mass index (BMI) for non-pregnant mothers was 21.8 kg/m². Participants' mean height was 1.52 meters, and non-pregnant participants' average mean weight for both time points was 50.3 kilograms. The correlation coefficient for weight measurements collected at both data collection periods was 0.88 ($r(539)$, $p < 0.001$). Non-pregnant participants were classified as underweight if they had a BMI < 18.5 kg/m²; 8.4% of non-pregnant participants were underweight. Mean MUAC of pregnant participants was 25.2 cm; 22.3% of pregnant participants had a MUAC < 23 cm and were classified as underweight. Together, 11% of pregnant and non-pregnant participants were underweight. There were 71 (11.9%) non-pregnant participants classified as overweight or obese (BMI > 25 kg/m²). Being overweight/obese was not associated with any independent variable and was not explored further in the analysis.

Maternal Diet

Maternal diet data was available from 804 participants (97.1%), of which 507 were present for both data collection periods. There were 223 participants who had diet

data from the September 2015 data collection period only, and 75 who had diet data from March 2016 only. The mean dietary diversity score was 2.45 for the September data collection (n=730, range 0-7) and the mean score was 2.80 for March 2016 data collection (n=581, range 0-6). Overall, average mean dietary diversity score from both time periods was 2.61 (Table 3.2). About 10% of participants in the first data collection period and 4% in the second data collection period reported consuming no food the previous day. There was a correlation of 0.02 ($r(507)$, $p=0.625$) between the two scores, excluding those who had reported consuming nothing in the previous day. There was little variation in the number of food groups consumed between the two time periods, and their low correlation may be due to restriction of range.

Around 42% of participants consumed only two food groups, 35% of participants consumed only three food groups, and 7% consumed four food groups in the first data collection period. In the second data collection period, 36% consumed two food groups, 35% consumed three food groups, and 19% consumed four food groups. Only 3% of the participants had an average dietary diversity score greater than five, representing Minimum Dietary Diversity according to the Minimum Dietary Diversity-Women indicator (Martin-Prével et al., 2015).

Respondents who consumed two food groups often reported consuming only *fufu*, a fluffy starch made from either cassava or corn flour, and *sombé* (cassava leaves) in the previous day, foods that fit in to the “starchy staples” and “dark green leafy vegetables” categories. Those eating three food groups often added meat/fish or beans in addition to *sombé* and *fufu* consumed. Those consuming four food groups most often reported a combination of *fufu*, *sombé*, meat/fish, and beans. In some cases, participants consumed

other types of dark green leafy vegetables, including sweet potato leaves, bean leaves, and *lenga-lenga*, or amaranth greens. Consumption of other vitamin A-rich fruits or vegetables was rare. Those with higher dietary diversity scores consumed fruits and vegetables, including tomato, avocado, eggplant, zucchini, mushroom, onion, mango, and guava, although the latter foods were mentioned rarely. Only a handful of participants consumed eggs or dairy.

Participants in Fizi territory had higher dietary diversity compared to Uvira (β : 0.22, $p=0.001$) and participants from the lakeside livelihoods zone had higher dietary diversity compared to the mountains (β : 0.33, $p=0.004$). Being classified as severely food insecure according to the HFIAS was negatively associated with dietary diversity (β : -0.26, $p<0.001$). PM2A group participants had significantly higher dietary diversity compared to WEG (β : 0.20, $p=0.038$). Living in one's territory of origin was associated with lower dietary diversity (β : -0.26, $p=0.001$). Good health was associated with lower dietary diversity compared to poor health (β : -0.23, $p=0.009$).

BMI was positively and significantly associated with being from Fizi territory (β : 0.97, $p<0.001$) and the Lakeside livelihoods zone (β : 1.20, $p=0.001$), household size (β : 0.14, $p=0.001$), age (β : 0.07, $p<0.001$), and number of children (β : 0.17, $p<0.001$). Participants in the PM2A group had lower mean BMI compared to WEG (β : -0.66, $p=0.037$). All categories of health status were significantly associated with higher BMI compared to poor health. Severe food insecurity was associated with lower BMI (β : -0.57, $p=0.016$). Current pregnancy was positively associated with underweight (OR: 3.15, $p<0.001$).

Associations between Mental Health, Diet and Nutritional Status

Multivariate analyses adjusted for covariates identified as potential confounding variables. Potential confounding variables were selected based on their conceptual relationship to dependent and independent variables, or being statistically significantly associated with both independent and dependent variables. Confounding variables identified were intervention group, age, education level, number of children, living in territory of origin, livelihoods zone, and self-reported health.

The results of the dietary diversity crude and adjusted analyses are shown in Table 3.3. In crude models, there was a positive relationship between higher mental health symptoms and dietary diversity score, with every 1-point increase in HSCL-25 score associated with an increase of 0.22 in dietary diversity ($p<0.001$). Similar results were found when assessing the HTQ score ($\beta: 0.17, p=0.002$), and high psychological distress ($\beta: 0.30, p<0.001$). In adjusted analyses, positive and significant relations between HSCL-25 ($\beta: 0.18, p=0.002$), HTQ ($\beta: 0.13, p=0.017$), and high psychological distress ($\beta: 0.27, p<0.003$) remained.

In the analysis with BMI as a dependent variable, BMI was negatively associated with increasing mental health symptoms, but these results were not statistically significant in either crude or adjusted models (Table 3.3). Unadjusted beta coefficients were -0.17 for HSCL-25 ($p=0.355$), -0.04 for HTQ ($p=0.833$), and -0.32 for high psychological distress ($p=0.235$). In the adjusted model, beta coefficients were -0.04 for HSCL-25 ($p=0.824$), 0.004 for HTQ ($p=0.980$), and -0.17 for high psychological distress ($p=0.534$).

There were no significant associations between mental health variables and odds of underweight in either crude or adjusted models, as shown in Table 3.3. The odds ratio

for underweight with a one-unit increase in HSCL-25 mean item score was 1.01 ($p=0.967$), and odds ratios underweight with one-unit increase in HTQ mean item score and high psychological distress were 1.01 ($p=0.959$) and 1.24 ($p=0.436$) respectively, in the crude analysis. In the adjusted analysis, the odds ratio for underweight with every one-unit increase in HSCL-25 mean item score was 0.91 ($p=0.640$), and odds ratios for underweight and every one-unit increase HTQ mean item score and high psychological distress were 0.98 ($p=0.915$) and 1.25 ($p=0.452$) respectively. The results were not significantly different with the exclusion of pregnant women from the analysis.

3.4 DISCUSSION

The results of this analysis revealed a significant positive association between higher symptoms of maternal mental health problems and dietary diversity score, and a negative but non-significant association between symptoms of maternal mental health problems and BMI. The prevalence of overweight/obesity was higher than the prevalence of underweight among non-pregnant women, but neither indicator was associated with mental health symptomatology. No association was found between maternal mental health and underweight.

Overall, participants' diets were poor, as they consumed less than 3 food groups per day on average. Approximately 80% of participants had symptoms of significant emotional distress (depression/anxiety symptoms combined) that have been considered clinically-relevant in other conflict-affected populations, and 60% of participants had symptoms of PTSD that would be considered clinically-relevant, having scored above 1.75 and 2.5 on the HSCL-25 and HTQ measures, respectively (Mollica et al., 1987; Mollica et al., 1992). These estimates are higher than the estimated 40% prevalence of

depression and 50% prevalence of PTSD reported previously in North and South Kivu provinces (Johnson et al., 2010), however these estimates were based on classification using different measures: the Patient Health Questionnaire-9 for depression symptoms and the PTSD Symptom Scale Interview (Spitzer et al., 1999; Ouimette et al., 2008). Other studies in sub-Saharan Africa that used the HSCL-25 have found a 60% prevalence of depression symptoms among internally-displaced people (IDPs) in northern Nigeria, and a 67% prevalence of depression symptoms among IDPs in Uganda, based on a cut-off point of 1.75 (Sheikh et al., 2015). Hadley et al. found that 42% of women in southwest Ethiopia had high emotional distress using the HSCL-25, and 17% had PTSD symptoms, based on a cut-off score of 2 (Hadley et al., 2008).

Studies conducted in the U.S. have shown that symptoms of maternal depression and anxiety are associated with disordered eating attitudes such as emotional and restrained eating, and a less healthy diet, but less research has been conducted in low and middle-income settings (Emerson et al., 2016; Hurley et al., 2005; Konttinen, 2010). One study in Iran showed that higher anxiety symptoms were associated with low dietary diversity among women (Poorrezaeian et al., 2015). In sub-Saharan Africa, food security, rather than dietary diversity, has most often been evaluated in relation to mental health. In rural Tanzania, food insecurity was strongly associated with depressive and anxiety symptoms among female caretakers (Hadley & Patil, 2008). In South Africa, food insecurity was associated with meeting symptom criteria for any 12-month and lifetime mental disorder in a nationally-representative sample of adults, and was also associated with postnatal depressive symptoms, hazardous drinking, and suicidality in a peri-urban sample of new mothers (Sorsdahl et al., 2011; Dewing et al., 2013).

In the present study, food insecurity was assessed as a potential confounding variable, and there was no association with being severely food insecure (compared to moderately insecure, mildly insecure, and food secure) and symptoms of mental health problems. The lack of significant findings for the analyses relating maternal mental health symptoms to BMI and underweight could be due to the extremely poor, food insecure environment. With almost 70% of the sample classified as severely food insecure, participants with mental symptoms may have diets affected more by availability and access to food than they are by mental health symptoms, such as reduced appetite or functional impairment. The finding that higher symptoms of distress are associated with higher dietary diversity may be because women with higher work burdens may be more vulnerable to psychological distress (Walters, 1993; Avotri & Walters, 1999), but they may also have more income with which to purchase more diverse foods.

Studies conducted in the U.S. have shown a U-shaped association between depressive symptoms and BMI, as symptoms are associated with both underweight and overweight/obesity among adults more generally (de Wit et al., 2009; Martin-Rodriguez et al., 2016). The present study did not find similar relations; mental health symptoms were not significantly associated with continuous BMI, overweight, and underweight. The intensely physical workload of women in rural DR Congo is also likely to impact their BMI, as findings from formative research conducted among this sample indicate that women are the primary agricultural producers and are often working in the fields the entire day (Burns et al., 2016). The effects of pervasive food insecurity and high physical activity on BMI, regardless of mental health symptoms, may have made it difficult to detect an association.

To our knowledge, this was the first study to assess maternal mental health in relation to maternal dietary diversity and anthropometric status in sub-Saharan Africa, and more research is needed in this region and other developing-country contexts. The main strength of the study is that it measures symptoms of multiple mental health problems in the same population, utilizing a questionnaire that has been developed specifically for this setting. However, the questionnaire may also have been a limitation, as it was previously utilized among a sample of sexual violence survivors. Sexual violence exposure was not highly prevalent in this sample, thus the HSCL-25 and HTQ scales may not have been the most valid measures.

Other limitations of this study include the lack of variation in dietary diversity scores and the overall poor diet of the sample, with only about 4% of the sample consuming more than five out of ten food groups. Additionally, some diet information was not obtained due to non-specific responses such as “meal with salad” or “food that builds and fortifies”; these types of responses (n= 46) were treated as missing. The responses may be indicative of an issue with data quality. Enumerators received training on the dietary data collection method prior to the survey, and questionable responses were flagged and addressed with individual enumerators. However, enumerators were generally inexperienced with dietary data collection using an open recall method, and this may have affected the reliability of the dietary diversity measure. Lastly, there were no measures of how participants spent their time each day, so the hypothesis that those with higher symptoms and higher dietary diversity may be related to higher work burden and subsequent higher income cannot be verified with available data.

The present results do not support the hypothesis that increased symptoms of mental health problems are associated with lower dietary diversity, lower BMI, and increased odds of underweight in the context of a rural, food insecure region of the DR Congo. The findings suggest that despite benefiting from a large-scale food security intervention, any improvements in household food security may not have necessarily extended to women's diets. Overall, participants had a poor diet, with the majority consuming only two or three food groups per day. Although Jenga Jamaa II did not target maternal nutrition through diet diversity, the results indicate that other programs seeking to improve maternal nutrition may need to look beyond improving household food security and income in order to ameliorate the poor quality of women's diets. Symptoms of depression, anxiety, and post-traumatic stress were highly prevalent among the study sample. Regardless of our findings, organizations implementing maternal and child health programs in similar contexts may need to consider a greater focus on maternal mental health and improving maternal diet quality via dietary diversity.

Table 3.1: Background Characteristics of 828 Mothers of Young Children

	Mean (SD) or N (%)
Territory	
Uvira	440 (53.1)
Fizi	388 (46.5)
Livelihoods Zone	
Mountains	114 (13.7)
Plains	459 (55.4)
Lakeside	255 (30.6)
Intervention Group ¹	
WEG	152 (18.4)
PM2A	285 (34.4)
FFS	118 (14.3)
F2F	113 (13.6)
Control	160 (19.3)
Household Size	7.8 (2.6)
Household Income, Median (IQR) ²	22500 (9500, 45000)
Severely Food Insecure ³	556 (67.8)
Maternal Age	29.62(6.3)
Education Level	
None	261 (31.7)
Some Primary School	401 (48.7)
Some Secondary School	162 (19.7)
Married	745 (90.1)
Ethnic Group	
Mubembe	350 (42.4)
Mufuliro	396 (47.9)
Murundi	16 (1.9)
Mushi	26 (3.1)
Muvira	11 (1.3)
Other	27 (3.3)
Living in Territory of Origin	618 (74.7)
Self-reported Health Status	
Poor	221 (26.9)
Average	298 (36.2)
Good	270 (32.8)
Very good/Excellent	34 (4.1)
Number of Children	5.4 (2.31)
Experienced Death of a Child	239 (28.9)
Pregnant	160 (19.3)

¹Household Food Insecurity Access Scale

²Past month, Congolese francs.

³WEG: Women's Empowerment Group, PM2A: Prevention of Malnutrition in Children under 2 Approach, FFS: Farmer Field Schools, F2F: Farmer to Farmer.

Table 3.2: Maternal Mental Health, Dietary Diversity, and Nutritional Status Descriptive Statistics

		Mean (SD) or N (%)	
Maternal Mental Health (n= 828)			
HSCL-25 ¹		2.30 (0.61)	
Mean HSCL-25 \geq 1.75 ¹		686 (82.9)	
Mean Depression Subscale \geq 1.75 ¹		684 (82.6)	
Mean Anxiety Subscale \geq 1.75 ¹		620 (74.9)	
HTQ ²		2.14 (0.64)	
Mean HTQ \geq 2.5 ²		496 (59.9)	
High Distress ³		165 (19.9)	
Maternal Nutritional Status (n= 782)			
MUAC Pregnant		25.22 (2.73)	
Underweight Pregnant		33 (22.3)	
Height (m)		1.52 (0.06)	
BMI (kg/m ²) ²		21.77 (2.77)	
Overweight/obese ²		71 (11.20)	
Underweight ²		53 (8.36)	
Underweight Total		86 (11.0)	
Weight (kg) ⁴	Time 1 (n= 585)	Time 2 (n= 488)	p-value
	50.89 (8.06)	49.49 (7.65)	< 0.001
Average Value	50.30 (7.60)		
Dietary Diversity Score (n= 804)			
	Time 1 (n=730)	Time 2 (n= 581)	p-value
	2.45 (1.22)	2.80 (1.06)	0.945
Average Value	2.61 (0.97)		

¹24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4, scores above 1.75 indicate probable depression/anxiety.

²16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4, scores above 2.5 indicate probable PTSD.

³Participants with mean item scores in the upper quartile of both measures (≥ 2.6 for the HSCL-25 ≥ 2.5 for the HTQ).

⁴Among 634 non-pregnant participants.

Table 3.3: Associations between Maternal Mental Health Symptoms and Maternal Dietary Diversity and Nutritional Status

Dietary Diversity Score (n= 776)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 ²	0.22	(0.10, 0.33)	<0.001	0.18	(0.06, 0.30)	0.002
HTQ ³	0.17	(0.06, 0.27)	0.002	0.13	(0.02, 0.24)	0.017
High Distress ⁴	0.30	(0.14, 0.47)	<0.001	0.27	(0.10, 0.45)	0.003
BMI (n= 616)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 ²	-0.17	(-0.53, 0.19)	0.355	-0.04	(-0.42, 0.34)	0.824
HTQ ³	-0.04	(-0.37, 0.30)	0.833	0.004	(-0.34, 0.35)	0.980
High Distress ⁴	-0.32	(-0.85, 0.21)	0.235	-0.17	(-0.72, 0.37)	0.534
Underweight (n= 761)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 ²	1.01	(0.69, 1.46)	0.967	0.91	(0.60, 1.37)	0.640
HTQ ³	1.01	(0.71, 1.43)	0.959	0.98	(0.68, 1.43)	0.915
High Distress ⁴	1.24	(0.72, 2.11)	0.436	1.25	(0.70, 2.26)	0.452

¹Adjusted for intervention group, age, education level, living in territory of origin, livelihoods zone, number of children, and health.

²24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4.

³16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4.

⁴Participants with mean item scores in the upper quartile of both measures (≥ 2.6 for the HSCL-25 and ≥ 2.5 for the HTQ).

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CHAPTER 4: MATERNAL MENTAL HEALTH AND CHILD DIET AND NUTRITIONAL STATUS

ABSTRACT

Maternal mental health problems have been linked to poor child nutritional outcomes, but studies evaluating this association in the context of sub-Saharan Africa have shown mixed results, and few studies assess maternal anxiety and post-traumatic stress symptoms. The present study examined the association between symptoms of maternal depression, anxiety, and post-traumatic stress disorder and child diet and nutritional status. Participants were 812 mother-child pairs from a larger study evaluating Jenga Jamaa II, a USAID-funded food assistance program in South Kivu, Democratic Republic of Congo.

Depressive symptoms and anxiety were measured by the Hopkins Symptom Checklist (HSCL-25) and post-traumatic stress was measured by the Harvard Trauma Questionnaire (HTQ), with a range of item scores from 1-4. Participants were classified as having high psychological distress if their mean item score was in the upper quartile of both measures. Child diet was measured by dietary diversity score (number of food groups consumed in the previous day, range 0-7) and meal frequency (number of meals or snacks in the previous day). Binary variables were created for minimum dietary diversity, met by children consuming at least four food groups, and minimum meal frequency, achieved by those consuming at least three or four meals or snacks. Children ranged from 2.6-5.6 years of age, and height-for-age z score, weight-for-age z score, weight-for-height z score, stunting, and underweight were assessed. Bivariate and multivariate regression analyses were conducted to evaluate the association between each

maternal mental health variable and each child diet and anthropometry variable.

Multivariate analyses adjusted for maternal age, education, intervention group, livelihoods zone, and number of children.

HSCL-25 (β : 0.18, $p=0.036$) and HTQ (0.19, $p=0.026$) were associated with higher dietary diversity but not positively associated with achievement of minimum dietary diversity. All maternal mental measures were associated with higher meal frequency: HSCL-25: β : 0.13, $p=0.001$, HTQ: β : 0.12, $p=0.001$, High Distress: β : 0.15, $p=0.014$. Maternal mental health was not associated with achieving minimum meal frequency when defined by consumption of four meals/snacks per day, but when defined by consumption of only three meals/snacks per day it was associated with all mental health measures (HSCL-25: OR: 2.06, HTQ: OR: 1.93, High Distress: OR: 2.68, $p<0.001$ for all). Maternal mental health variables were not associated with any child anthropometric variables. Overall, children's anthropometric status and diets were poor. Their older age range may have limited the study's ability to detect an association.

4.1 INTRODUCTION

Globally, 50 million children are estimated to be affected by wasting due to acute undernutrition and 156 million children by stunting due to chronic undernutrition, with more than one-third of stunted children from sub-Saharan Africa (UNICEF et al., 2016). Sub-optimal child feeding practices remain highly prevalent, with only 37% of children exclusively breastfed for the first six months according to UNICEF and WHO guidelines (Victora et al., 2016). Maternal mental health problems may contribute to the high prevalence of undernutrition, as maternal depression symptoms are associated with an estimated 40% increase risk of stunting (Surkan et al., 2011).

The association between maternal mental health problems and child undernutrition may be mediated by child care and feeding practices, as studies in low-income settings have found that maternal mental health problems are associated with early cessation of breastfeeding, non-responsive feeding behaviors, and poor maternal-infant interaction (Rahman et al., 2016; Galler et al., 2006; Adewuya et al., 2008; Hurley et al., 2008; Tomlinson et al., 2005). Symptoms of depression, particularly fatigue, feelings of hopelessness, and lack of self-confidence, also may manifest behaviorally in poor care-seeking behavior. Study results suggest that children of mothers with depressive symptoms are less likely to receive all follow-up vaccinations and have higher incidence of diarrheal disease and febrile illnesses; thus, they may be more susceptible to undernutrition (Rahman et al., 2007; Rahman et al., 2004a; Guo et al., 2013).

Most evidence for the association between maternal mental health problems and child undernutrition comes from South Asia. Studies in sub-Saharan Africa have mixed results. Interestingly, it appears that most studies with significant associations recruited samples from clinic or hospital settings, and studies of community-based samples often

found no association. One study among a sample of mothers and children attending an immunization clinic in rural Nigeria found that infants of mothers with depressive symptoms, measured using the Structured Clinical Interview for DSM-III-R, had lower weight-for-age and height-for-age (Adewuya et al., 2008). Results of a case-control study among patients admitted to a hospital in Uganda showed that children of mothers with depressive symptoms (assessed using the depression module of the Mini International Neuropsychiatric Interview) were more likely to have height-for-age, weight-for-age, or weight-for-height z scores < -3 or a mid-upper arm circumference < 115 mm compared to those of mothers without depressive symptoms (Ashaba et al., 2015). In a study conducted at a child health clinic in Malawi, length-for-age z scores were lower among infants whose mother had symptoms of mental health problems, but the study did not find an association with weight-for-age z scores (Stewart et al., 2008). Maternal mental health was measured using the WHO Self-Reporting Questionnaire (SRQ), which consists of 20 items to assess depression, anxiety, and somatic symptoms (World Health Organization, 1994). Children recruited from child health clinics in Zambia whose mothers had symptoms of mental health problems, measured using the SRQ, had lower height and weight measurements compared to those whose mothers did not have symptoms (Ndokera & MacArthur, 2011). Lastly, results of a study conducted among children attending a child welfare clinic in Northern Ghana were three times more likely to be stunted if their mothers had depressive symptoms, which were assessed using the Centre for Epidemiologic Depression Screening (CED-S) questionnaire (Wemakor & Mensah, 2016).

Studies finding no association include two conducted among population-based

cohorts in Ethiopia, as well as one in which participants were recruited from a peri-urban settlement in South Africa (Medhin et al., 2010; Tomlinson et al., 2006; Harpham et al., 2005). In Ethiopia, Medhin et al. (2010) used the SRQ with a cut-off point of 6 to define high levels of mental health symptoms, and Harpham et al. (2006) used the same measure with a cut-off point of 7. Tomlinson et al. (2006) used the Structured Clinical Interview for DSM-IV (SCID). A multi-country study that took place in Ethiopia, Bangladesh, and Vietnam found that symptoms of maternal mental health problems, defined as a SRQ score > 7 , were associated with diarrhea and respiratory illnesses in all three sites, but Ethiopia was the only country in which maternal mental health problems were not associated with stunting (Nguyen et al., 2014).

The range of measures and cut-offs used to classify symptoms of maternal mental disorders makes it difficult to draw comparisons between studies, but the mixed evidence presented here indicates a need for further research in sub-Saharan Africa. To our knowledge, no studies have evaluated relations between post-traumatic stress disorder and child nutritional status, and there has been little research on how maternal mental health problems relate to complementary feeding practices or feeding of non-breastfed children. The objective of the present analysis is to examine the association between symptoms of maternal mental health problems and the diet and nutritional status of young children in Uvira and Fizi territories, South Kivu, DR Congo. We hypothesized that higher symptoms of mental health problems are associated with lower anthropometric z scores, increased odds of stunting and underweight, lower dietary diversity and meal frequency, and decreased odds of achieving minimum dietary diversity and minimum meal frequency.

4.2 METHODS

Setting and Participants

This study is nested within a larger study evaluating Jenga Jamaa II, a USAID Food for Peace-funded multi-year assistance program in South Kivu. Program interventions were implemented by the non-governmental organization Adventist Development and Relief Agency (ADRA). A detailed description of the study setting is provided in Chapter 2. The parent study enrolled 1,820 households participating in Jenga Jamaa II interventions and a control group. Interventions included Women's Empowerment Groups (WEG), the Prevention of Malnutrition in Children under Two Approach (PM2A), Farmer Field Schools (FFS), and Farmer to Farmer (F2F) approaches (Mathys & Remancus, 2010). Of the 1,820 households enrolled in the parent study, 1,243 households had children whose anthropometry and diet were assessed. Children born between July 2010 and December 2012 were eligible for enrollment. Children in the PM2A group either received rations (6-24 months of age as of July 1, 2012) or their mothers received rations while pregnant or lactating (children born between January 2011 and December 2012) during the same study period; thus, children from all other groups were recruited at the same time to allow for comparison of anthropometric and diet indicators across groups. A total of 1,385 children were enrolled in the parent study, as 138 households had multiple children meeting eligibility criteria. Jenga Jamaa II parent study participants who were mothers of children also enrolled in the parent study were eligible for the present analysis.

Procedure

Data collection for the Jenga Jamaa II parent study occurred from August 2013 through March 2016, with surveys conducted every six months. The parent study

collected data on household income, food security, and child diet indicators via a questionnaire, and child anthropometry was assessed at the same time. The present analysis relied on these data from the last year of the study in which surveys were conducted in September 2015 and March 2016. A questionnaire collecting data on maternal mental health and maternal background characteristics was added to the parent study survey during these time points. Most data were from the September 2015 survey (n=683), but in cases where either the mother or child were absent in September 2015 but both were present in March 2016, data from the March 2016 survey were used in the analysis (n=129). All child diet and anthropometric data corresponded to the same time point in which maternal mental health data were collected.

Data were collected by trained ADRA field agents using the mobile data collection application Magpi and Android tablets (DataDyne, 2015). Data collection instruments and procedures were approved by the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health. Oral informed consent was requested from participants at each data collection encounter for the parent study, and additional consent detailing potential risks and benefits of participation was requested prior to the maternal mental health assessment.

Measures

Maternal Mental Health

Mental health was assessed using an adapted version of the DRC Gender-Based Violence Psychosocial Questionnaire, which was developed for use in a randomized controlled trial of a cognitive behavioral therapy for Congolese survivors of sexual violence (Bass et al., 2013). On the basis of findings from qualitative studies in several

communities in South Kivu, the authors selected the Hopkins Symptom Checklist-25 (HSCL-25) and the Harvard Trauma Questionnaire (HTQ) to measure symptoms of depression, anxiety, (HSCL-25) and post-traumatic stress disorder (HTQ) (Derogatis et al., 1974; Mollica et al., 1992). As described in the previous chapter, the validity of the HSCL-25 and HTQ has been assessed in similar settings and the HTQ is frequently used among conflict-affected populations (Foss et al., 2004; Lee et al., 2008; Rieder & Elbert, 2013; Mollica et al., 1992; Rasmussen et al., 2015). The previous chapter also described the pilot test of the mental health questionnaire among the study population, which assessed inter-rater and test-retest reliability of HSCL-25 ($r(27) = 0.41, p = 0.03$) and HTQ ($r(27) = 0.40, p = 0.005$) scales using Pearson product moment correlation coefficients. Using data from the complete sample, Cronbach's coefficient alpha was 0.92 for the HSCL-25 items, and 0.91 for the HTQ items, indicating good internal consistency reliability (Cronbach, 1951; Lee et al., 2008). Depression and anxiety subscales in the HSCL-25 were highly correlated ($r(810) = 0.72, p < 0.001$). The HSCL-25 and HTQ scales were also highly correlated ($r(810) = 0.81, p < 0.001$).

The questionnaire used a four-point Likert scale, with participants rating the frequency of each symptom in the prior four weeks. Responses ranged from 1 (not at all) to 4 (a lot). One item on suicidality was excluded from the HSCL-25 due to ethical considerations. It has been estimated that 40% of women have experienced sexual violence in Eastern DR Congo (Johnson et al., 2010). Because of the anticipated high prevalence of trauma exposure due to sexual violence, mothers were asked if they had experienced sexual violence, and when it had occurred. Exposure to other traumatic events was not assessed.

Child Anthropometry

Weight and height measurements were taken by trained ADRA field agents using standardized protocols (Lohman et al., 1988). A Model 1582 Tanita Mommy and Baby Infant Scale (Arlington Heights, IL) and a Shorr Productions (Olney, MD) height/length board were used to measure children. Height-for-age z score (HAZ), weight-for-age z score (WAZ), and weight-for-height z scores (WHZ) were calculated for children 6-59 months of age using the 2006 WHO child growth standards with the user-written Stata program zscore06 (WHO Multicentre Growth Reference Study Group, 2006; Leroy, 2011). Anthropometric z scores for children over 5 years of age (n= 30) were calculated using the 2007 WHO reference for children 5-19 years, using the Stata program zanthro (World Health Organization, 2007; Vidmar et al., 2013). Z scores greater than 6 or less than -6 were considered implausible and treated as missing (n= 4). Children with HAZ of less than -2 were classified as stunted, and children with WAZ of less than -2 were classified as underweight. Due to the low prevalence of wasting (WHZ < -2) in the sample (0.66%), wasting was not assessed as an outcome.

Child Diet

Children's diet was evaluated using World Health Organization indicators for infant and young child feeding practices (World Health Organization, 2010). Dietary diversity was assessed by asking mothers whether children consumed any foods from seven food groups the previous day, and a dietary diversity score (range 0-7) was calculated from the sum of food groups consumed. The seven food groups assessed were starchy staples (grains, roots, and tubers), legumes and nuts, dairy products, flesh foods, eggs, Vitamin A-rich fruits and vegetables, and other fruits and vegetables. Children

consuming at least four of the seven food groups were classified as having achieved the Minimum Dietary Diversity indicator. This diet data collection method differed from the open recall method for maternal dietary data collection described in Chapter 3, as this was method used by the parent study from which child diet data were obtained.

Meal frequency was calculated by asking mothers how many meals or snacks their children consumed the previous day. Breastfed children who consumed at least 3 meals the previous day, and non-breastfed children who consumed at least 4 meals were classified as having achieved the Minimum Meal Frequency Indicator. A secondary analysis was conducted for non-breastfed children using the measure of consuming at least 3 meals as having achieved minimum meal frequency, as it may be a more appropriate indicator given the older age range of the children. These indicators were designed to assess the diets of children 6-23 months of age. Comparable indicators have not been developed to assess the diets of older children. Minimum Acceptable Diet, a composite indicator identifying children having achieved both minimum dietary diversity and minimum meal frequency, was not assessed due to the low prevalence of children achieving this indicator in the sample (1.32%).

Demographic and Socioeconomic Measures

Household-level variables were collected as part of the Jenga Jamaa II survey. Household size, household income (in the past month), and severe food insecurity were assessed. Severe food insecurity was classified based on the Household Food Insecurity Access Scale (HFIAS), which assesses the frequency of occurrence of uncertainty in the household food supply, insufficient quality of foods, and insufficient food intake in the past month (Coates, 2007). The HFIAS has been found to distinguish between food

secure and food insecure households in a variety of cultural contexts (Coates et al., 2006). Household income in the past month was not evaluated as a potential confounding variable, because it was not considered an appropriate measure of socio-economic status. Five indicator variables for each of the four intervention groups or the control group were created, as well as variables for geographic region (Uvira or Fizi territory) and livelihoods zone (plains, mountains, or lakeside). Data on maternal background characteristics included maternal age, years of education, ethnic group, marital status, currently living in territory of origin, currently pregnant, maternal self-reported health status (poor, average, good, very good/excellent), number of children the mother was responsible for, and having a child who died. Maternal education was recoded as a categorical variable with three categories: no education, completed at least some primary school, and completed at least some secondary school.

Statistical Analysis

Sample size and power calculations were conducted under the assumption that at least 40% of mothers would have elevated symptoms of mental health problems based on prior research in Eastern DR Congo, and 65% of children would be stunted, based on Jenga Jamaa II parent study data (Johnson et al., 2010; Doocy et al., 2014). The following formula was used: $N_1 = [Z_{\alpha} + \exp(-\theta^*/4)Z_{\beta}]^2(1+2P\delta)/(P\delta^*)$; where P = the estimated prevalence of stunting, θ^* = the log odds ratio, and $\delta = [1+(1+\theta^*)\exp(5\theta^*/4)][1+\exp(-\theta^*/4)]^{-1}$ (Hsieh, 1989). With α of 0.05 and 80% power ($\beta = 0.2$), a sample of 393 mother-child pairs would be sufficient to detect an odds ratio of 1.4, measuring the association between high levels of maternal mental health symptoms and child stunting in univariate logistic regression (Hsieh, 1989). This number would be

sufficient to detect results similar to those reported elsewhere for the association between symptoms of maternal mental health problems and child stunting (Surkan et al., 2011).

The dependent anthropometry variables were continuous height-for-age z score (HAZ), weight-for-age z score (WAZ), and weight-for-height z score (WHZ), and indicator variables for stunting ($HAZ < -2$) and underweight ($WAZ < -2$). The dependent child diet variables were continuous dietary diversity score and meal frequency, and variables for achieving Minimum Dietary Diversity and achieving Minimum Meal Frequency.

Maternal mental health independent variables were mean item HSCL-25 score measuring symptoms of depression and anxiety, mean item HTQ score measuring PTSD symptoms, and a binary variable identifying mothers in a state of high psychological distress who had mean scores in the upper quartile of both measures (mean item HSCL-25 score ≥ 2.7 and mean item HTQ score ≥ 2.6). Secondary analyses conducted with mental health variables constructed based on cut-off points established in prior studies for probable depression, anxiety, overall emotional distress, and post-traumatic stress, as described in Chapter 3. The results of these analyses are presented in Appendix Tables 1.2 and 1.3.

Exploratory data analysis included assessing distributions of continuous variables and frequencies of categorical variables. Bivariate regression analysis was used to test for associations between background variables, independent variables, and dependent variables. Univariate regression analyses were conducted for each combination of independent and dependent variables, followed by multivariate regression analyses

controlling for potential confounding variables. Separate analyses were conducted for the three independent variables due to multicollinearity.

4.3 RESULTS

Participant Characteristics

Maternal mental health data were collected from 932 mothers of children under five enrolled in the Jenga Jamaa II study who were present during one or both of the data collection periods for the present analysis. There were 120 participants with no data on child diet or anthropometry. These participants were excluded from the analysis. There were 138 participants who had multiple children enrolled in the study and present for data collection, including 13 sets of twins. In these cases, one child was randomly selected for exclusion. Among the remaining pairs of siblings, the older sibling was excluded (n=56). One sibling was excluded from the analysis due the potential for clustering, with younger siblings retained since older children would be less vulnerable to growth faltering. Overall, there were 812 mother-child pairs included in the analysis, of which 683 were present for the September 2015 survey, and an additional 129 were present for the March 2016 survey. There were 671 children with complete anthropometry and diet data, 63 with only diet data, and 78 with only anthropometry data.

Background and demographic characteristics of the study sample are reported in Table 4.1. Over half (52.8%) lived in Uvira territory, and the majority lived in the plains livelihoods zone (55.7%) followed by the lakeside and mountains zones, with 31% and 13.3% respectively. Approximately one-third (35%) were enrolled in the PM2A intervention group, 19.3% in the Control group, 18.1% in WEG, 14.7% in FFS, and 13.2% in F2F. Average household size was 7.9 people, and the majority of households

(65.9%) were classified as severely food insecure according to the HFIAS. Median household income was 22,500 Congolese francs, or approximately \$23 (IQR: 9500, 45000).

Mean maternal age of the sample was 30.1 years, and 89.9% of participants were married. About 32% of participants had never been to school, 48.5% had received at least some primary schooling, and 19.8% at least some secondary schooling. Most participants were from the Mubembe (42.4%) or Mufuliro (47.6%) ethnic groups, and the rest were divided among Murundi (2%), Mushi (3.3%), Muvira (1.5%), and other (3.2%) ethnic groups. Seventy-five percent of participants lived in their territory of origin. Participants had an average of five children (range: 1-11), and 17.9% were pregnant at the time of data collection. Almost one-third (30.5%) had at least one child who died. Slightly over half (52.3%) of children were female, and children's mean age was 46.2 months (range 32.1- 68.1). Thirty children (3.6%) were over five years of age. Only 16 (2.1%) children were still being breastfed.

Maternal Mental Health

Descriptive statistics for the independent variables are presented in Table 3.2. Participants' average mean score on the HSCL-25 scale was 2.31, and their average mean score on the HTQ scale was 2.15. There were 139 participants (17.1%) whose mean item scores were in the upper quartile of both measures and considered to have high psychological distress. A total of 675 (83.1%) of participants had mean item scores ≥ 1.75 on the HSCL-25, and 488 (60.1%) had mean item scores ≥ 2.5 on the HTQ; these cut-off points have been used to identify clinically relevant symptoms in other conflict-affected populations (Mollica et al., 1987; Mollica et al., 1992). Because these cut-off

points have not been empirically validated in Eastern Congo, variables classifying probable depression/anxiety and PTSD symptoms based on them were evaluated as independent variables. The percentage of participants (5.9%) who reported experiencing sexual violence was lower than expected, and severity of mental health symptoms did not vary by sexual violence exposure.

Statistically significant associations were found between maternal mental health variables and background characteristics. HSCL-25 score was positively, but weakly associated with household size (β : 0.02, $p=0.015$). The Control group had a lower HSCL-25 score on average compared to WEG (β : -0.18, $p=0.009$), which may be because WEG women were recruited from particularly vulnerable, female-headed households. Having at least some secondary education was associated with lower HSCL-25 score (β : -0.12, $p=0.047$). Number of children was positively associated with HSCL-25 (β : 0.03, $p=0.001$), and living in one's territory of origin was negatively associated with HSCL-25 (β : -0.16, $p=0.001$). Participants with self-reported health status of average, good, or very good/excellent had lower HSCL-25 scores than those reporting poor health ($p<0.001$ for all). Similar trends were found when evaluating the association between HTQ and high psychological distress and background characteristics, with a few exceptions. The F2F (β : -0.19, $p=0.02$) group, in addition to the Control (β : -0.21, $p=0.005$) group, had significantly lower mean HTQ compared to WEG. Having had at least one child that died was associated with higher HTQ score (β : 0.11, $p=0.030$). Participants had decreased odds of being classified as having high psychological distress if they lived in the plains (OR: 0.55, $p=0.04$) or lakeside (OR: 0.42, $p=0.002$) livelihoods

zones. Severe food insecurity according to HFIAS classification was associated with decreased odds of high psychological distress ($\beta = 0.62, p = 0.013$).

Child Diet

Descriptive statistics for the diet-related dependent variables are displayed in Table 4.2. Children's diets were poor; average dietary diversity score was 3.09. Minimum dietary diversity (consuming at least 4 food groups) was achieved by 40.7% of children. Children were fed on average 2.17 meals or snacks the previous day. Only 14 children, or 1.9% of the sample, achieved minimum meal frequency of four meals/snacks per day. However, if the threshold for achieving minimum meal frequency is lowered to three meals/snacks per day, 24.4% of the children would achieve this indicator.

Consumption of starchy staples was highly prevalent, with 83% of children consuming food from this group the previous day. More than half (65%) of children consumed flesh foods, and 80% consumed Vitamin A-rich foods. Almost half (46.3%) of children consumed pulses, and 26.5% of children consumed other non-Vitamin A-rich fruits or vegetables. Very few children consumed eggs (2.4%) or dairy (7.6%) foods. The sample children were between 2.5 and 6 years of age, an age by which they were likely to be eating family foods. Common meals consumed in this area of Eastern Congo consist of *fufu*, made from corn or manioc flour, as well as *sombé*, manioc leaves that are considered a dark green leafy vegetable and therefore rich in vitamin A. Small, dried fish (*ndagala*) are also popular and may contribute to the high prevalence of flesh food consumption in this sample.

Children living in the lakeside livelihoods zone had better dietary diversity compared to those living in the mountains, and odds of achieving minimum dietary

diversity were marginally associated with household size and number of children. Meal frequency was negatively associated with living in Fizi territory and being from a severely food insecure household, and odds of achieving minimum meal frequency (consuming at least four meals) was negatively associated with the number of children living in the household. F2F and Control group children had lower meal frequency compared to WEG.

Child Anthropometry

Children had low HAZ scores and stunting was highly prevalent (Table 4.2). Mean HAZ was -2.38 , and 63.8% of children were stunted ($HAZ < -2$). Mean WAZ was -1.31 , and 22.3% of children were underweight ($WAZ < -2$). Mean WHZ was 0.17, and only 0.7% of children were wasted ($WHZ < -2$). Wasting was not assessed because of its low prevalence, which indicates that children were much less affected by acute malnutrition than chronic malnutrition and stunting. HAZ and WAZ were positively associated with maternal age, and negatively associated with male sex. Older maternal age, current pregnancy, and being in the PM2A group were associated with decreased odds of stunting.

Associations between Maternal Mental Health, Child Diet, and Child Nutritional Status

Crude and adjusted results of the regression analyses evaluating the associations between maternal mental health variables and child diet variables are displayed in Table 4.3. Multivariate analyses adjusted for maternal age, education, intervention group, livelihoods zone, and number of children. Child age and child sex were not identified as

potential confounding variables in the exploratory analyses, thus were not included as covariates.

In the crude analysis, higher mean item HSCL-25 score (higher scores indicating greater distress) was associated with an increase of 0.17 in dietary diversity score ($p=0.047$), and in the adjusted analysis it was associated with an increase of 0.18 in dietary diversity score ($p=0.036$). Higher mean item HTQ score was associated with an increase of 0.18 in dietary diversity score ($p=0.029$) in the crude analysis, and with 0.19 increase in dietary diversity ($p=0.026$) in the adjusted analysis. High psychological distress was not associated with dietary diversity. No mental health variable was associated with achieving minimum dietary diversity.

Small but significant associations were found between all mental health indicators and higher meal frequency. In the crude analysis, HSCL-25 score was associated with an increase of 0.14 in meal frequency for every unit increase in the score ($p<0.001$), HTQ score was associated with an increase of 0.13 in meal frequency ($p<0.001$), and high psychological distress was associated with an increase of 0.16 in meal frequency compared with mothers with less distress ($p=0.01$). In the adjusted models, HSCL-25 score was associated with an increase of 0.13 in meal frequency for every unit increase in the score ($p=0.001$). HTQ score was associated with an increase of 0.12 in meal frequency ($p=0.001$). Children of mothers with high psychological distress had an increase of 0.15 in meal frequency compared with mothers with less distress ($p=0.014$).

There was no significant association between maternal mental health and achieving minimum meal frequency (≥ 4 meals) in the crude analysis. The model failed to converge in the adjusted analysis due to the low prevalence of children achieving this

indicator (1.9%). When minimum meal frequency was calculated based on children consuming three meals/snacks per day, both crude and adjusted analyses showed statistically significant relations. In the crude analyses, the odds ratio of achieving minimum meal frequency was 2.04 for every unit increase in HSCL-25 score, 1.98 for every unit increase in HTQ score, and 2.71 for children of mothers with high psychological distress ($p < 0.001$ for all). In the adjusted analyses, the results were similar: the respective odds ratios were 2.06, 1.93, and 2.68 for high psychological distress ($p < 0.001$ for all).

Crude and adjusted results of the regression analyses evaluating the associations between maternal mental health variables and child anthropometry variables are displayed in Table 4.4. Multivariate analyses included maternal age, education, intervention group, livelihoods zone, and number of children as covariates. Higher HSCL-25 scores were associated with lower HAZ and lower WAZ, but these associations were not statistically significant. Higher HSCL-25 and HTQ scores were associated with 17-29% increased odds of stunting in the adjusted models, but these were not statistically significant. There was no association between mental health variables and WHZ or odds of underweight.

4.4 DISCUSSION

The level of mental health symptoms was higher than expected, as 80% of mothers had symptoms that would be indicative of significant emotional distress based on a cut-off point of 1.75 on the HSCL-25. Other studies evaluating the association between maternal mental health and child nutrition have found a lower prevalence of mothers with depressive symptoms; for example, in Ethiopia studies estimated that 5-39% of mothers

assessed experienced mental health problems, measured using the WHO Self-Reporting Questionnaire (Medhin et al., 2010; Harpham et al., 2005; Nguyen et al., 2014). Significant positive associations were found between higher symptoms of maternal mental health problems and child diet indicators. Higher maternal depression/anxiety and PTSD symptoms were associated with higher child dietary diversity, and higher symptoms of depression/anxiety and PTSD symptoms and high psychological distress were associated with higher meal frequency and increased odds of achieving minimum meal frequency (if defined by three meals per day). Prior research has shown that sub-optimal child feeding practices are associated with maternal depressive symptoms, stress, and anxiety (Blissett et al., 2007; Hasselmann et al., 2008; Ystrom, 2012). No other studies have shown a positive association of maternal depression/anxiety symptoms and higher dietary diversity. The association between maternal mental health and these specific child feeding indicators has been evaluated in Ethiopia, Bangladesh, and Vietnam. No differences were found between mothers with high and low levels of mental health problems, comparing the prevalence of children achieving minimum dietary diversity, minimum meal frequency, and minimum acceptable diet (Nguyen et al., 2014). The only exception was in Vietnam where mothers with higher symptoms of mental health problems were less likely to have children achieving the minimum acceptable diet indicator.

The positive and significant association of symptoms of maternal mental health problems with higher meal frequency maybe explained by research findings from more developed settings showing that maternal mental depression and anxiety are associated with perceived child fussiness (Edhborg et al., 2000; Perren et al., 2005). Perceived child

fussiness has been associated with forceful and controlling feeding practices, as distressed mothers may feed their children more frequently to pacify them (Hurley et al., 2008; Mitchell et al., 2009). However, the age of the children in this sample may indicate that this was not the case; children 3-6 years of age may be more likely to be left in the care of siblings or other family members during the day compared to younger children. In such instances, mothers may not be able to accurately report details on child food consumption. Qualitative research in this population revealed that most women work outside of the home, engaged in commerce and agricultural activities, which often necessitates leaving even young children in the care of others (Burns et al., 2016).

One possible explanation for the surprising findings could be that community mechanisms exist to support mothers in greater distress; for example women whose husbands have left them and who are having a difficult time caring for their children may go to live with relatives who are able to provide the family with more resources and access to food. However, no data is available from this study to support this hypothesis. Women who work more may experience more symptoms of mental health problems due to increased stress, but have a higher income and are therefore able to feed their children more diverse foods and with greater frequency. Research in both high and low income country settings has shown a link between somatic and depressive symptoms and women's high work burden (Walters, 1993; Avotri & Walters, 1999).

The present study showed no significant association between maternal mental health symptoms and child anthropometry, assessed by continuous HAZ, WAZ, WHZ, and dichotomous indicators for stunting and underweight. Other studies in sub-Saharan Africa among community samples have failed to find an association between maternal

mental health and child anthropometry (Medhin et al., 2010; Harpham et al., 2005; Nguyen et al., 2014; Tomlinson et al., 2006). In rural Malawi, mothers with mental health problems had infants with significantly lower length-for-age, but there was no significant association with weight-for-age (Stewart et al., 2008). Studies in Nigeria, Uganda, and Ghana have found a negative association between maternal mental health problems and child growth, although not necessarily risk for undernutrition. These studies have all taken place in facility settings (Adewuya et al., 2008; Ashaba et al., 2015; Bakare et al., 2014; Wemakor & Mensah, 2016). Study samples who live in close proximity to a health facility and are able to pay for health services may be of higher socio-economic status compared to samples not recruited from health facility settings (Magadi et al., 2003; Harris et al., 2011), which may make it easier to detect an association. The nutritional status of samples with lower socio-economic status may be more affected by poverty and food insecurity compared to impaired caregiving due to maternal mental health problems. Other researchers have hypothesized that overall poor socioeconomic status of populations in rural Africa may make it difficult to parse out the specific effects of maternal mental health on child growth (Stewart, 2007). In the present study, almost 70% of the participating households were severely food insecure, 64% of children were stunted, and all participants were extremely poor. The lack of variation in children's nutritional status and restriction of range in the mental health variables may have limited the study's ability find an association.

A limitation of the study that may explain the lack of association between maternal mental health and child growth is the age of children enrolled. Stunting or low HAZ may be indicative of maternal mental health problems at an earlier age, when

children are more vulnerable to growth faltering. Children in the present study were older than the 0-2 years of age window in which stunting occurs, and mothers who were depressed when their children were younger may not necessarily have been depressed when the study occurred if their symptoms had dissipated. Another potential limitation of the study are the measures used for maternal mental health. Although the HSCL-25 and HTQ are commonly used to measure mental health in conflict-affected and refugee populations (Mollica et al., 1987; Mollica et al., 1992; Silove et al., 1998; Foss et al., 2004), other measures such as the SRQ are more frequently used to assess symptoms of maternal mental health problems in relation to child nutritional status. The measures were selected for the original study (Bass et al., 2003) for use with a sample of sexual violence survivors; thus they may not have been an appropriate measure for a sample that had not experienced such recent trauma.

To our knowledge, this is the first study to evaluate maternal PTSD symptoms and child nutritional status, and to evaluate relations between maternal mental health and child nutrition in a post-conflict setting. Additionally, few studies have assessed maternal mental health symptoms in relation to child diet indicators and child nutritional status. The findings reported here are supported by the congruent findings reported in Chapter 3. The analysis conducted in Chapter 3 found that mothers with higher levels of mental health symptoms had higher dietary diversity, and no association was found with maternal BMI and underweight.

In conclusion, our study findings show that higher maternal mental health symptoms were positively associated with children's dietary diversity and meal frequency. The reasons for these findings are unclear based on available data. Maternal

mental health was not associated with child nutritional status, findings which are similar to several prior studies in sub-Saharan Africa which have shown no association between maternal mental health problems and child undernutrition. Research on this topic is lacking in post-conflict settings such the DR Congo, yet symptoms of maternal mental health problems, sub-optimal child feeding practices, and child undernutrition were pervasive. Future studies are needed to explore the role of community or family mechanisms that may be supporting distressed mothers, which could explain the positive association with child diet, and to understand how women's work burden may be related to mental health status, income, and child feeding practices.

Table 4.1: Background Characteristics of 812 Mother-Child Pairs

	Mean (SD) or N (%)
Territory	
Uvira	429 (52.8)
Fizi	383 (47.2)
Livelihoods Zone	
Mountains	108 (13.3)
Plains	452 (55.7)
Lakeside	252 (31.0)
Intervention Group ¹	
WEG	147 (18.1)
PM2A	282 (34.7)
FFS	119 (14.7)
F2F	107 (13.2)
Control	157 (19.3)
Household Size	7.9 (2.8)
Household Income, Median (IQR) ²	22500 (9500, 45000)
Severely Food Insecure ³	530 (65.9)
Maternal age (y)	30.1 (7.2)
Education level	
None	257 (31.7)
Some primary school	393 (48.5)
Some secondary school	160 (19.8)
Married	729 (89.9)
Ethnic Group	
Mubembe	319 (42.4)
Mufuliro	358 (47.6)
Murundi	15 (2.0)
Mushi	25 (3.3)
Muvira	11 (1.5)
Other	24 (3.2)
Living in Territory of Origin	609 (75.0)
Number of Children	5.48 (2.4)
Experienced Death of a Child	248 (30.5)
Pregnant	145 (17.9)
Child sex (female)	425 (52.3)
Child Age	
2-3 years	81 (10.0)
3-4 years	390 (48.0)
4-5 years	311 (38.3)
Over 5 years	30 (3.7)
Currently Breastfed	16 (2.1)

¹WEG: Women's Empowerment Groups, PM2A: Preventions of Malnutrition in Children under 2 Approach, FFS: Farmer Field Schools, F2F: Farmer to Farmer.

²Past month, Congolese francs.

³Household Food Insecurity Access Scale category.

Table 4.2: Maternal Mental Health, Child Diet, and Child Nutritional Status Descriptive Statistics

Maternal Mental Health (n= 812)	
	Mean (SD) or N (%)
HSCL-25 ¹	2.31 (0.60)
Mean HSCL-25 ≥ 1.75 ¹	675 (83.1)
Mean Depression Subscale ≥ 1.75 ¹	671 (82.6)
Mean Anxiety Subscale ≥ 1.75 ¹	617 (76.0)
HTQ ²	2.15 (0.63)
Mean HTQ ≥ 2.5 ²	488 (60.1)
High Distress ³	139 (17.1)
Child Diet	
Dietary Diversity Score (n= 734)	3.09 (1.42)
Min. Dietary Diversity ⁴	229 (40.7)
Meal Frequency (n=714)	2.17 (0.62)
Min. Meal Frequency of 4 meals/day	14 (2.0)
Min. Meal Frequency of 3 meals/day	174 (24.4)
Child Nutritional Status	
HAZ (n= 749)	- 2.38 (1.18)
Stunting	478 (63.8)
WAZ (n= 753)	-1.32 (0.94)
Underweight	168 (22.3)
WHZ (n=753)	0.17 (0.92)
Wasting	5 (0.66)

¹24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4, scores above 1.75 indicate probable depression/anxiety.

²16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4, scores above 2.5 indicate probable PTSD.

³Participants with mean item scores in the upper quartile of both measures (≥ 2.7 for the HSCL-25 and ≥ 2.6 for the HTQ).

⁴Consuming at least 4 of 7 food groups the previous day.

Table 4.3: Associations between Maternal Mental Health Symptoms and Child Diet

Dietary Diversity Score (n= 724)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 ²	0.17	(0.00, 0.34)	0.047	0.18	(0.01, 0.36)	0.036
HTQ ³	0.18	(0.02, 0.34)	0.029	0.19	(0.02, 0.35)	0.026
High Distress ⁴	0.10	(-0.16, 0.37)	0.447	0.15	(-0.12, 0.42)	0.283
Meal Frequency (n= 714)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 ²	0.14	(0.06, 0.22)	<0.001	0.13	(0.05, 0.21)	0.001
HTQ ³	0.13	(0.06, 0.20)	<0.001	0.12	(0.05, 0.20)	0.001
High Distress ⁴	0.16	(0.04, 0.27)	0.010	0.15	(0.03, 0.27)	0.014
Minimum Dietary Diversity (Consumed \geq 4 Food Groups)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 ²	1.08	(0.52, 1.03)	0.521	1.09	(0.84, 1.40)	0.523
HTQ ³	1.06	(0.84, 1.33)	0.629	1.06	(0.83, 1.34)	0.640
High Distress ⁴	1.06	(0.73, 1.56)	0.748	1.09	(0.74, 1.62)	0.659
Minimum Meal Frequency (Consumed \geq 4 Meals)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 ²	1.17	(0.48, 2.84)	0.724	omitted		
HTQ ³	1.20	(0.52, 2.77)	0.662	omitted		
High Distress ⁴	omitted			omitted		
Minimum Meal Frequency (Consumed \geq 3 Meals)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 ²	2.04	(1.53, 2.75)	<0.001	2.06	(1.52, 2.81)	<0.001
HTQ ³	1.98	(1.50, 2.61)	<0.001	1.93	(1.45, 2.58)	<0.001
High Distress ⁴	2.71	(1.81, 4.04)	<0.001	2.68	(1.77, 4.05)	<0.001

¹Adjusted for maternal age, education, intervention group, livelihoods zone, and number of children.

²24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4.

³16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4.

⁴Participants with mean item scores in the upper quartile of both measures (≥ 2.7 for the HSCL-25 and ≥ 2.6 for the HTQ).

Table 4.4: Associations between Maternal Mental Health Symptoms and Child Nutritional Status

Height-for-Age Z Score (n= 746)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 ²	-0.07	(-0.21, 0.07)	0.307	-0.07	(-0.21, 0.08)	0.356
HTQ ³	-0.03	(-0.17, 0.10)	0.624	-0.03	(-0.17, 0.10)	0.618
High Distress ⁴	-0.13	(-0.36, 0.09)	0.245	-0.13	(-0.36, 0.10)	0.265
Weight-for-Age Z Score (n= 750)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 ²	-0.03	(-0.15, 0.08)	0.557	-0.02	(-0.14, 0.09)	0.689
HTQ ³	-0.01	(-0.12, 0.09)	0.797	-0.00	(-0.11, 0.10)	0.956
High Distress ⁴	-0.10	(-0.28, 0.08)	0.291	-0.08	(-0.26, 0.10)	0.398
Weight-for-Height Z Score (n= 753)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 ²	0.03	(-0.08, 0.14)	0.602	0.04	(-0.07, 0.15)	0.510
HTQ ³	0.04	(-0.07, 0.14)	0.480	0.05	(-0.05, 0.16)	0.316
High Distress ⁴	0.02	(-0.16, 0.19)	0.863	-0.08	(-0.26, 0.10)	0.398
Stunting (n= 746)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 ²	1.17	(0.91, 1.50)	0.232	1.17	(0.90, 1.52)	0.241
HTQ ³	1.19	(0.94, 1.51)	0.152	1.20	(0.94, 1.54)	0.151
High Distress ⁴	1.30	(0.86, 1.96)	0.218	1.29	(0.84, 1.98)	0.246
Underweight (n= 750)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 ²	0.98	(0.74, 1.31)	0.899	0.95	(0.71, 1.29)	0.761
HTQ ³	0.96	(0.73, 1.27)	0.797	0.93	(0.70, 1.24)	0.638
High Distress ⁴	1.09	(0.69, 1.72)	0.713	1.05	(0.65, 1.69)	0.836

¹Adjusted for maternal age, education, intervention group, livelihoods zone, and number of children.

²24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4.

³16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4.

⁴Participants with mean item scores in the upper quartile of both measures (≥ 2.7 for the HSCL-25 and ≥ 2.6 for the HTQ).

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CHAPTER 5: MATERNAL MENTAL HEALTH AND CHILD FEEDING PRACTICES: A QUALITATIVE ANALYSIS

ABSTRACT

Maternal mental health problems are associated with poor child growth and sub-optimal child feeding practices, yet little qualitative research has been conducted to assess mothers' perceptions about how psychological distress may impact their ability to care for and feed their children. The objective of the study was to understand the stressors mothers face in low resource settings and how psychological distress impacts their daily functioning, particularly their child feeding practices. The study took place in South Kivu, DR Congo, and was nested within a larger evaluation of a USAID-funded food security program.

Mothers of children under five years of age who participated in a previous mental health assessment were eligible. The assessment measured symptoms of depression and anxiety using the Hopkins Symptom Checklist-25, symptoms of post-traumatic stress disorder using the Harvard Trauma Questionnaire, and 14 locally-relevant symptoms identified from a prior study conducted in South Kivu. A mean item score was calculated (range 1-4).

Purposive sampling was used. Participants were selected from those who had mean item scores in the upper and lower quartiles, representing high and low levels of psychological distress. Twenty in-depth interviews and two focus group discussions were conducted, with a total of 35 mothers. Key informant interviews were conducted with five local health workers. Interviews and focus groups were audio-recorded and transcribed in Swahili, and transcripts were translated to French by bilingual research

assistants. The analysis was conducted using an approach adapted from Grounded Theory, with transcripts coded by the student investigator, and codes then grouped according to theme.

Major themes to emerge were that women's husbands were a significant source of distress ("hurting heart"), with husbands' infidelity, abandonment, and lack of financial support commonly mentioned by participants. Participants reported that their experiences of distress made them lose their appetite or lose weight, and their poor nutritional status made it difficult to breastfeed their children. They also felt that psychological distress was associated with milk insufficiency, and a decrease in affection towards their children. Overall, participants perceived that women experiencing stressful life events and related symptoms of psychological distress had difficulty functioning. Differences were found between high and low distress participants; low distress participants may have had better relationships with their husbands, greater social support, and did not perceive there to be a link between psychological distress and breastfeeding. The findings point to the need for responsible parenting interventions targeted at fathers, which may be beneficial for both maternal mental health and child nutrition outcomes. Integration of maternal psychosocial support with infant and young child feeding interventions may also have beneficial effects for mothers and children.

5.1 INTRODUCTION

There has been growing recognition of an association between maternal mental health problems and child undernutrition, especially in low and middle income countries. Studies from low-income countries have revealed negative associations between maternal depressive symptoms and child growth, although the pathways for are not always clear (Surkan et al., 2011; Stewart, 2007; Adewuya et al., 2008; Black et al., 2009). Studies from both low and high-income countries have found that maternal depression and anxiety symptoms are related to child care and feeding practices, such as early cessation of exclusive breastfeeding, early introduction of complementary foods, non-responsive feeding styles, negative attitudes towards breastfeeding, increased child diarrheal incidence, and reduced adherence to vaccination schedules; thus poor child care and feeding practices may serve as a mediator between maternal mental health problems and poor child growth (Hurley et al., 2008; Galler et al., 2006; Hasselmann et al., 2008; Rahman et al., 2007; Rahman et al., 2004a; Wasser et al., 2011). There has been little effort to understand mothers' own perspectives about how the care and feeding of their children may be affected by psychological distress.

Most qualitative research on maternal mental health is focused on the perinatal period. Studies conducted in sub-Saharan Africa have mainly focused on the stressors experienced by women and their perceptions of symptoms (Stewart et al., 2015; Hanlon et al., 2009b; Mwape et al., 2012; Kaaya et al., 2010; Bass et al., 2008; Sawyer et al., 2011). Another body of literature relates to barriers to optimal child feeding practices (Kimani-Murage et al., 2015; Nankumbi & Muliira, 2015; Kruger & Gericke, 2003). One study in Kinshasa, the capital of DR Congo, found that cultural beliefs and the perception that babies were not consuming enough milk were common reasons for giving

water or formula to infants (Yotebieng et al., 2013). Another study in DR Congo among the same population assessed in the present study found that women's high work burden, lack of financial decision making power in the household, and poverty were major barriers to optimal child feeding practices (Burns et al., 2016). To our knowledge no qualitative research has been undertaken in sub-Saharan Africa regarding perceived links between maternal mental health problems and child feeding practices.

The objective of the present study was to understand perceptions of how maternal mental health problems are related to mothers' daily functioning, particularly in the care and feeding of the children. This study builds on a quantitative assessment of the association between maternal mental health problems and maternal and child diet and nutritional status reported in Chapters 3 and 4.

5.2 METHODS

Participants

Study participants were sampled from a larger study evaluating Jenga Jamaa II, a United States Agency for International Development (USAID) Food for Peace multi-year assistance program implemented by the non-governmental organizations Adventist Development and Relief Association (ADRA) and World Vision in South Kivu, DR Congo. The study setting is described in greater detail in Chapter 2. In the parent study, 1,820 households were enrolled from four intervention groups- Women's Empowerment Groups (WEG), the Prevention of Malnutrition in Children under 2 Approach (PM2A), Farmer Field Schools (FFS), and Farmer to Farmer (F2F)- and a control group. Parent study surveys, measuring key indicators of household food security, child diet, and child nutritional status, occurred twice yearly from August 2012 through March 2016.

Study participants who were mothers of children under five years of age were eligible for participation in in-depth interviews (IDI) and focus groups discussions (FGD) for the present study. Key informant interviews were conducted with local health workers, from either government-run health clinics in the study area or health/nutrition field agents employed by ADRA.

Procedure

Maternal mental health was measured using a questionnaire adapted from the DRC Gender Based Violence Psychosocial Questionnaire (Bass et al., 2013). Depression and anxiety symptoms were assessed using the Hopkins Symptom Checklist-25 (HSCL-25) and post-traumatic stress disorder (PTSD) symptoms were assessed using the Harvard Trauma Questionnaire (HTQ) (Derogatis et al., 1974; Mollica et al., 1992). The questionnaire also included 14 items measuring locally-relevant symptoms such as stigma and fear of being talked about, which were identified through qualitative research during the development of the questionnaire (Bass et al., 2013). Mental health data were collected in September 2015, concurrently with a parent study survey.

Data collection for the present study occurred over four weeks in March 2016, coinciding with data collection for the final parent study survey. A purposive sampling strategy was employed, with eligible participants stratified by territory (Uvira and Fizi) and livelihoods zone (plains, lakeside, mountains). A list was compiled of participants who scored in the upper (scores above 2.55) or lower (scores below 1.83) quartiles of the distribution of mental health symptom scores, with higher scores representing a greater level of distress and lower scores representing less distress (range 1-4). The participants' children enrolled in the study (n= 35) ranged in age from 34 to 59 months, and none were

currently breastfed. However, participants may have had younger children who were not enrolled in the parent study. On average one to two interviews were conducted per day during the survey period, and participants were sampled from both high and low levels of distress. Efforts were made to achieve an even distribution of participants from each intervention group and the control group.

Interviews and focus groups were conducted in a private area, out of hearing range of other study staff, family, and community members. Three female ADRA field agents from Health/Nutrition and Gender sectors were trained in qualitative research methods and interview techniques. For each IDI and FGD, one served as a note-taker and the remaining two facilitated the discussion. Notes were reviewed with the student investigator immediately after each IDI and FGD in order to identify new themes to follow up in subsequent interviews, and address any issues or concerns. IDIs and FGDs were held in Swahili. Key-informant interviews were conducted by the student investigator in French, with the exception of one interview which required French-Swahili translation assistance from an ADRA field agent. All interviews and focus groups were audio-recorded with digital recording devices.

Twenty IDIs were conducted, 13 with mothers who had high levels of distress and seven with mothers who had low levels of distress. One FGD was conducted in each territory, with 7 participants in Uvira and 8 participants in Fizi. Participants were selected for FGD participation from villages close in geographic proximity. Participants were selected for IDIs from villages that were not sampled for focus groups. The key-informant interviews (KIIs) were conducted with three staff members of rural government-run health clinics and two ADRA Health and Nutrition field agents. The

numbers of interviews and focus groups conducted were based on logistical considerations, as the qualitative research took place during the larger survey of 1,820 households. The study team did not have the capacity to increase the sample size. Major themes described in this paper reached saturation despite limitations on the number interviews and focus groups that could be conducted.

Interview and focus group discussion guides were developed with input from the local study team as well as mental health experts. For IDIs and FGDs, two vignettes were developed based on findings from prior field experiences in the study setting on issues related to women's mental health and child feeding practices. They were finalized with input from the study team. The first vignette described a woman who had been abandoned by her husband and subsequently experienced symptoms of depression including apathy and fatigue. She lost motivation to continue her agriculture activities which were her main source of income, and her children eventually became undernourished. In the second vignette, another woman was described who was cultivating her crops with her friends when one of her friends was attacked by armed men. In the following weeks, she had recurring nightmares and flashbacks and was too fearful to return to the field. She believed that her milk has dried up from the stress, and stopped breastfeeding her children. She went to the health center for advice, but was unable to concentrate on what the nurse told her.

The vignettes were read aloud to facilitate discussion. Participants were asked about reactions to these stories, and to describe women in their community who had similar problems. Participants were asked how these kinds of problems would affect functioning, in particular the care and feeding of their children. The FGD guide did not

ask about participants' personal experiences in order to protect their confidentiality, but asked them to describe how these problems affected women in their community. IDI and FGD guides were translated from English to Swahili by local research assistants. The study team reviewed all guides prior to data collection to identify issues with translation and comprehension, and the guides were adjusted accordingly.

The guides for the key-informant interviews covered similar themes but did not include the vignettes. Key informants were asked about the problems and stressors facing women in their community, and how women's functioning would be impacted when experiencing psychological distress. The key-informant guide was developed in English and translated to French by local research assistants.

The study protocol was approved by the Institutional Review Board of the Johns Hopkins Bloomberg School of Health. Oral informed consent in Swahili was obtained for participation in the parent study, and additional informed consent was obtained for all components of the sub-study, including participation in the maternal mental health assessment, as well as for interviews and focus group discussions. Consent scripts were adapted to describe the specific risks and benefits of participation in each activity.

Analysis

Audio recordings of interviews and focus groups were first transcribed in Swahili by Congolese research assistants with prior experience conducting qualitative research. The Swahili transcripts were then translated to French by the same research assistants. The analysis was conducted in French by the student investigator using methods adapted from Grounded Theory, in which codes were grouped into concepts and categories from which theories about the research were then developed (Glaser et al., 1968; Charmaz,

2006). An initial codebook was developed based on review of IDI/FGD notes. Transcripts were reviewed and coded, and the codebook was adapted throughout the process. Codes were then grouped into categories based on themes emerging from the data. Figure 5.1 displays an analytical tree of code categories and response codes for each. Code categories were relationships with husbands, other stressors, effects of stressors and psychological distress, child care and feeding practices, and positive outcomes related to child health and family relationships. Coding was facilitated by the qualitative research software ATLAS.ti, Version 1.0.50 (Markgraf et al., 2015). The most salient themes from the response codes for each category and quotes were identified that offered a rich description of participants' perspectives. Finally, IDI transcripts were stratified according to level of psychological distress (high or low), and codes were reviewed again to evaluate differences between high and low distress participants.

5.3 RESULTS

Background and demographic characteristics of in-depth interview and focus group participants are displayed in Table 5.1. There were 20 mothers of children five years of age and under who participated in IDIs and 15 mothers who participated in FGDs. Ten interviews were conducted in villages throughout Uvira territory (Katogota, Nyakabere, Bwegera, Nyamutiri, Lubarika, Ndolera, Kibungu, Langala, and Lemera), and ten were conducted in villages throughout Fizi territory (Ilakala, Kabumbe, Kaboke, Tchonwe, Lulinda, Bitobolo, Kalundja, Sebele Buzimba, Sebele Kianda, and Mwandiga). Five were participants in the Jenga Jamaa II WEG intervention, four were in the PM2A, four were in FFS, three were in F2F, and four were in the Control group. Uvira focus group participants (n=7) were from Itara, Rugobagoba, Majengo, and Kirindangumi

villages and all four Jenga Jamaa II interventions were represented (WEG, PM2A, FFS, F2F). The Fizi focus group had eight participants representing the villages of Katanga, Mukinja and Katalukulu, and the WEG, Control, and PM2A groups.

The mean age of mothers participating was 30.2 years, 41.2% had no education, 32.4% had at least some primary school, and 26.5% had some secondary school education. The majority (61.8%) of participants were currently living in their territory of origin. Participants had on average 6.3 children, and 94.3% were married. About half (48.6%) of participants were from the Mubembe ethnic group, 42.9% from the Mufuliro group, and 8.5% from other ethnic groups. The average household size was 8.3 people, the median household income in the past month was 30,000 Congolese francs (approximately \$31), and 74.3% of participants were severely food insecure.

Participants' average mean score on the HSCL-25 (depression and anxiety symptoms) was 2.53, and the average mean HTQ score (PTSD symptoms) was 2.36. HSCL-25 and HTQ scores were highly correlated ($r(34) = 0.90, p < 0.001$). Participants average mean score for all items, including the 14 locally-relevant symptoms in addition to the HSCL-25 and HTQ items, was 2.39. Eight IDI participants were classified as having low psychological distress based on the results of the mental health questionnaire (scores between 1.09 and 1.80) and 12 were classified as having high psychological distress (scores between 2.56- 3.61). The Uvira focus group had five participants classified as having high psychological distress (scores between 2.56 and 3.35) and two participants with low distress (scores between 1.43 and 1.78). The Fizi focus group had five participants with high psychological distress (scores between 2.61 and 3.28) and two participants with low distress (scores between 1.67 and 1.78).

Two key-informant interviews were conducted in health clinics in Uvira territory (one general physician in Lubarika and a nurse in Kibungu) and three were conducted in Fizi territory (one clinical officer in Mukinja and two ADRA health/nutrition field agents in Baraka).

Relationships with Husbands

Participants perceived that husbands' behavior, including lack of financial support, infidelity, and abandonment, was a significant source of psychological distress. Their immediate reaction after hearing the vignettes was most often that they knew of someone like the woman described in the first vignette or they had the same issues with their own husbands. Participants reported that their husbands frequently took other wives or mistresses, and they lived in fear of their husbands completely abandoning them for other women. One participant described how she was affected by her husband's behavior:

I have a spouse who is the champion of marrying many women in this community...When he married other women immediately I felt defeated and didn't even have the strength to go cultivate. When I see my children immediately I felt bad. (High Distress IDI Participant, Lubarika)

Another participant said that her husband's relationship with her neighbor induced frequently-reported distress symptoms of 'thinking too much' (Swahili term) and weight loss, saying "During this time I became very thin because of thinking so much about this situation" (High Distress IDI Participant, Kabumbe).

Their husbands' prolonged absences for work or other reasons, coupled with financial dependency on husbands, made it difficult for participants to care for their families. One participant described her reaction to her husband's prolonged absence:

I was worried because it was only me in charge of the children...worries and tears...My heart was troubled, I was tired, worn out because he had just left. I wanted to also leave and abandon everything, the children, but was convinced to stay. (High Distress IDI Participant, Bitobolo)

Another participant said that her "heart felt bad" when her husband abandoned her, "not the kind of malaise that would bring you to the hospital, but an interior pain, nothing to be done about it" (High Distress IDI Participant, Mwandiga).

When husbands were present, they often did not provide adequate support. In some cases, husbands worked alongside their wives to cultivate the fields, but then took all of the harvest to sell themselves (rather than consume) and did not put the income towards the family. When children fell ill, fathers often refused to pay their medical expenses. Many participants reported that their husbands did not contribute to pay their children's school fees. Additionally, many participants said that their husbands would take what little money they earned to spend on alcohol, and often described their husbands as "drunks." The lack of support from their husbands left participants struggling to meet basic needs, and was also a source of stress.

Secondary sources of stress related to their husbands included fear of getting a sexually transmitted disease, particularly HIV/AIDS, due to husbands' infidelity. Several women reported that they or other women in their community were mocked or stigmatized due to their husbands' abandonment. In some cases, women living on their

own were accused of adultery or prostitution. One participant said: “Certain neighbors mocked me and some said to return to [my parents’ house] because my husband left, instead of staying by myself” (High Distress IDI Participant, Nyamutiri).

Other Stressors

Other problems participants frequently discussed were poverty and food insecurity. Most participants were engaged in agriculture but the harvest was poor:

In brief, life is very bad here in Bwegera...As soon as you don’t have an income-generating activity, there’s great suffering in the household to feed the children, for education, and health care. (High Distress IDI Participant)

A doctor in the local health center described food insecurity as a source of “psychological trauma”:

Psychological traumas come from the fact that someone who cultivates their field well and is able to eat, feed the children, and now it doesn’t produce anymore. You have today the problem of ‘mosaique’ [African cassava mosaic virus] that effectively lowered production, from which came cases of malnutrition among children in the household and this provoked psychological traumas because families can’t withstand the conditions in their life following the deteriorating soil quality. (KII Participant, Health Worker, Lubarika)

Child malnutrition and illness as a result of food insecurity was another source of stress reported by participants. Participants reported that lack of food was a frequent cause of child malnutrition, and children often suffered from diarrhea and anemia. Paying for frequent medical care and hospitalizations was a financial burden for many households: “Even since my husband left, I’ve had a lot of difficulties with anemia

among the children and I've had to find money to pay the hospital" (High Distress IDI Participant, Ilakala).

Few women reported violence as a source of stress in their lives. In some areas, sexual violence committed by armed groups had been a problem up until a few years ago, but participants said that recent cases were rare. One participant said she had fled armed men and stopped going to the fields as a result. In one focus group, participants discussed a particular group of cattle herders that threatened them in the fields, and they were afraid to return to this area to cultivate. None of the participants mentioned experiencing domestic violence specifically, although one ADRA health worker mentioned it:

There is also the problem of violence in the family, domestic violence, violence in various domains. When women cultivate their field, men don't participate, but once the crops are sold the men take the money in their hands which is economic violence. If women refuse, they're threatened by domestic violence. (KII

Participant, ADRA Field Agent, Baraka)

Indeed, this kind of "economic violence" as described by the health worker was a much more commonly reported experience for these women compared to conflict-related violence. IDI and FGD participants did not mention intimate-partner violence specifically, but the high prevalence of intimate-partner violence in DR Congo indicates that it may have affected some participants despite not being discussed (Peterman et al., 2011).

Psychological Distress and Psychosomatic Problems

Most participants reported somatic symptoms in relation to their stressful experiences. Weight loss and lack of appetite were frequently reported, as well as general pain and feeling “sick in the heart.” In some cases, “sickness/hurting of the heart” meant hypertension when participants were pushed for further clarification. When one participant’s child died, she said she felt pain in her body and fell ill. When asked what kind of sickness, she said it was sickness of the heart and she did not have an appetite. One participant said:

I became seriously thin in a way that people mocked me...really a lot of suffering, pain in the heart, I spent almost a year in my house without going out until my friend intervened and got me back to doing my activities. (Uvira FGD

Participant)

Another participant described similar symptoms, saying, “It’s difficult to even eat, my heart feels bad and I don’t have peace. I ask myself questions like how am I going to educate my children, I don’t know” (Fizi FGD Participant).

It was very common for participants to report weight loss in times of stress: “I don’t feel good because my weight has gone down due to the problems that gnaw at me. I weighed 40 kilograms or more before, now I barely weigh 37 kilograms” (High Distress IDI Participant, Tchonwe). One participant said she lost weight because of “thinking a lot” about her situation. Another participant said, “Before the problems between me and my spouse I was 60 kilograms but now I weigh 40 kilograms. In fact, I lost weight because of the issues with my husband and I had a lot of problems” (Low Distress Participant, Ndolera).

Many participants associated stressful life events, psycho-somatic problems, and weight loss with deteriorating physical health:

*When I was in crisis...I had lost so much weight. My sister-in-law said you refuse to eat *sombé* [cassava leaves] here, you are going to suffer. I was almost gone...*

(Uvira FGD Participant)

Another woman said her health had deteriorated because of “thinking a lot.” Being sick was also a source of stress as participants were unable to work. “That put me in a difficult situation because I couldn’t go to the fields and I didn’t have anything more to eat...that’s the difficulty I have above all because I’m not well-nourished” (High Distress IDI Participant, Bitobolo).

Linking Stressors and Psychological Distress to Functioning

To gain an understanding of how mental distress might affect women’s functioning, participants were asked what activities they thought would be difficult for someone like the women described in the vignettes. When asked what tasks would be difficult for women experiencing distress, almost universally participants responded with cultivating their fields, doing household tasks, looking for firewood, preparing food, or paying for clothes and education for their children. Some specified that these tasks would be difficult because they “feel bad” or lack strength. Interviews with health workers supported these findings: “That happens here, when a woman is stressed do you think that she can still go to the field to cultivate?” (KII Participant, ADRA Field Agent, Baraka). Another health worker said, “In this case feeding also becomes a problem, it’s the mother that looks for food...she will rarely go to the field because she’s frustrated

and this will negatively affect the feeding of the children” (KII Participant, ADRA Health Worker, Baraka).

Linking Stressors and Psychological Distress to Child Feeding Practices

Participants also saw a link between mental distress and child feeding practices particularly breastfeeding. “When you have problems, you don’t breastfeed like you should, you sit there with your hand on your forehead and a lot of worries and pain in the heart” (Uvira FGD Participant). They often perceived that stress caused milk insufficiency: “I have to tell you that I had insufficient milk with my second-to-youngest child because of the troubles gnawing at me. Anyway, the last child had difficulties because there’s no milk due to the troubles” (Fizi FGD Participant). When one woman was asked how she felt breastfeeding her six-month old infant after her husband had left, she said, “As I was so troubled I didn’t have enough milk to give to the child” (High Distress IDI Participant, Bitobolo). When asked how she feels breastfeeding when her heart feels bad, one participant said “I lose my head, especially when I breastfeed a lot” and mentioned that she did not have any milk (High Distress IDI Participant, Sebele Kianda). Another participant said, “I have troubles...When I had my baby I had difficulty finding food and when I breastfeed I feel pain in my heart” (High Distress IDI Participant, Kabumbe).

Participants frequently made an association between poor maternal nutritional status and difficulties breastfeeding. During a stressful time, one participant said, “I felt pain in my breast while breastfeeding due to the lack of food...I felt bad and I didn’t have sufficient milk” (High Distress IDI Participant, Kabumbe). Another participant said she currently had sufficient milk, but sometimes her milk is insufficient due to “lack of food

and many troubles.” One participant who had several children die said that she became serious thin afterwards and was advised to stop breastfeeding. Regardless of mental health status, participants felt that they could breastfeed well when they were eating well themselves, and when they were eating poorly they felt pain when breastfeeding or had perceived milk insufficiency.

In terms of complementary feeding practices, participants mainly attributed feeding difficulties to poverty. Yet to the extent that mothers perceived psychological distress as linked with problems breastfeeding, it would also result in early introduction of complementary foods. Often they could only afford staple foods and it was more difficult to incorporate animal source foods in children’s diets:

Children are suffering at all times because they eat very poorly, the situation is very bad. When you find 1,000 francs you go directly to buy flour instead of buying fish or meat so that the children have food...The day passes, they become malnourished because the children eat very poorly. (Low Distress IDI

Participant, Nyakabere)

Generally, children ate the same foods as the rest of the household, which were often cassava (*fufu*) with cassava leaves (*sombé*) and beans. Sometimes small fish and meat were consumed when they could afford it. Younger infants were often given porridge first, and then family foods as they got older. Participants said that they and their children often ate only once or twice a day, far less than the WHO/UNICEF-recommended 3-4 meals or snacks per day (World Health Organization and UNICEF, 2003). Additionally, most participants left their children with the child’s older siblings or grandparents while

they worked, and a few even reported leaving the children by themselves, therefore they were unable to feed their children throughout the day.

Some participants attributed psychological distress to a deterioration in children's health and nutritional status. One participant said that for mothers like the ones described in the vignettes, their children would lack strength and fall ill. Another mentioned that the children's health would deteriorate because the mother would stop preparing food for the children. One of the health workers said that if a mother was experiencing psychological distress during weaning, she may not be able to find adequate complementary foods, having a negative effect on the health of the children. Therefore, "the mother's stress can affect the life of the infant or young child" (KII, ADRA Field Agent, Baraka).

Another theme that emerged was the lessening of affection towards children when the mother felt distressed. One participant described this phenomenon:

And the love toward the child diminishes when one is in a time of difficulty as you think of the difficulty caused by their father. You have a load and the child increases the load, the love decreases. It is said in the rules or principles of feeding, the child should look at you and you should reciprocate with a smile.

(Uvira FGD Participant)

Another participant said that when someone is troubled, they do not want the child to approach them. One of the ADRA health workers had also discussed the decrease in affection towards the child, in cases when the mother blames the child during times of distress: "She can try to avoid the children, saying 'Step aside, I suffer and bear the problems of the family because of you the children,'" (KII, ADRA Field Agent, Baraka).

Experiences of Low Distress Participants

Although similar themes emerged between high and low distress in-depth interview participants, interviews conducted among low distress participants tended to be shorter in duration and less rich in content. Participants in the low distress group were more likely to discuss abandonment by their husband as an issue affecting other women in their community rather than affecting them personally. One participant said this situation had affected her mother:

When the father leaves to travel, the mother and children stay suffering, for example my mother, when her husband left to travel he stayed there for 2 years without even sending her a franc...My mother was struck by lack of money, food.

(Low Distress IDI Participant, Ndolera)

In some cases they discussed social support as a moderating factor that reduced the negative impact of their husbands' behavior. One low distress participant said her husband did not work or contribute financially, but that her mother-in-law helped with providing food. Another participant mentioned that support and advice from other women in the community helped her overcome conflict with her unfaithful husband, and "for the moment there's a change in the household" (Low Distress IDI Participant, Lulinda). Several low distress participants reported good relationships with their husbands, including one that said her husband stayed with her hospitalized child and helped her in the fields:

I don't have any problem with my husband because we live well together with my mother-in-law...He doesn't do anything in the house without consulting me.

Troubles can come at any moment but when you live together you have to have a dialogue. (Low Distress IDI Participant, Kaboke)

Almost twice as many participants in the high distress group mentioned that breastfeeding would be difficult when feeling distressed. Low distress participants sometimes mentioned problems with breastfeeding due to their poor nutritional status or lack of access to food: “Because I don’t eat well, when the child breastfeeds I feel pain in my breast. The child doesn’t eat and I have a reduction in milk” (Low Distress IDI Participant, Nyakabere). Another participant said she didn’t have breastmilk because she did not have enough access to food, and gave hot water to her child when she felt her milk was insufficient. She said that she did not feel differently about breastfeeding during times when she has a lot of problems. One participant reported that she only had insufficient breastmilk when she was sick, but would continue to breastfeed the child because “it is their right” (Low Distress IDI Participant, Kaboke). Similarly, another participant said she breastfed “like normal” even when experiencing problems (Low Distress IDI Participant, Kalundja).

Several low distress participants did not identify with the vignettes, and felt that women who experience these kinds of problems should continue with their normal activities:

I can’t stay at the house [like the woman in the vignette] because I don’t have food. It’s better to go to the field instead of staying at the house, that doesn’t have any importance. I’m obliged to do agricultural work so that I can find food for my children. (Low Distress IDI Participant, Nyakabere)

Another participant said, “There’s no work in the house that can stop because of problems or worries. Even if one is worried, one won’t stop kneading *fufu* for the children” (Low Distress IDI Participant, Kalundja). These participants did not see the link between psychological distress and functioning that was affirmed by high distress participants.

All participants faced similar challenges and stressors, but some may have been more acute for the high distress participants, and high distress participants tended to relate more to the topics discussed. Low distress participants may have had greater social support, either through friends or extended family, that served as protective factors. Low distress participants did not perceive that problems or worries affected their ability to breastfeed or function normally.

5.4 DISCUSSION

The most salient theme to emerge was that poor relationships with their husbands were a significant source of distress for participants, with husbands often traveling for prolonged periods, taking other mistresses or wives, or abandoning their wives completely. Husbands were perceived to contribute little to the household financially, and the fact that many husbands had children with multiple women increased the financial strain on households. This finding is supported by other literature from other low-income countries. In Malawi, infidelity, abuse, and abandonment by husbands was a stressor for women in the perinatal period, in addition to poverty, lack of support, and child illness (Stewart et al., 2015). One multi-country study found that lack of social support, poor relationships with partners, and husbands’ infidelity were a source of stress for postpartum mothers (Oates et al., 2004). In one study in Kinshasa, the capital of DR

Congo, new mothers said that partner infidelity and lack of support were problems they had that affected their children (Bass et al., 2008), issues which also resonated among participants in this study.

Some low distress participants reported good relationships with their husbands, or discussed social support mechanisms which may have mitigated the negative impact of husbands' behavior and other stressors on their well-being. Social support has long been considered to have a "buffering" effect on stress (Cohen & Wills, 1985). In a study of people living with HIV/AIDS in Uganda, social support reduced the effects of food insecurity on depressive symptoms (Tsai et al., 2012), and social support has been found to be a moderator for the effects of stressors on mental health symptoms in a variety of contexts (Wang & Xu, 2016; Douge et al., 2014; Xie et al., 2009).

Poverty and food insecurity emerged as other stressors, with most participants struggling to provide food on a day-to-day basis, and worrying about how to pay for children's school fees and hospital bills when they fell ill. These findings are consistent with quantitative studies that have linked poverty and food insecurity with depressive symptoms. Studies in low-income populations in the U.S. have found that depressive symptoms are associated with household food insecurity among adults (Leung et al., 2015) and pregnant women (Hromi-Fiedler et al., 2011; Laraia et al., 2006). Studies among mothers in Tanzania and South Africa have found associations between household food insecurity and symptoms of depression and anxiety (Hadley & Patil, 2008; Dewing et al., 2013). Food insecurity was also associated with depressive symptoms among adults more generally in South Africa, and depressive and PTSD symptoms in adults in Ethiopia (Sorsdahl et al., 2011; Hadley et al., 2008). Relative poverty has also been

identified as a correlate of depressive symptoms among women in low-income country settings (Adewuya, 2005; Aderibigbe et al., 1993; Edwards et al., 2006; Deyessa et al., 2008; Christiani et al., 2015; Patel et al., 1999), and poverty has been associated with depressive symptoms in women in high-income country settings as well (Brown & Moran, 1997; Amutah-Onukagha et al., 2016).

Participants in the present study often mentioned “thinking too much” as a symptom of distress, which has been found to be a common idiom of distress across cultures (Kaiser et al., 2015). Depression-like symptoms were described as having a “hurting heart,” an idiom which has emerged from research in other settings including Haiti, West Africa, and South Asia (Keys et al., 2012; Fox, 2003; Kohrt & Harper, 2008). Many associated weight loss with psychological distress, which could be due to loss of appetite, increased food insecurity, or a combination of both. Loss of appetite is a symptom of depression, and increased activity (potentiating weight loss) is a symptom of both depression and anxiety (American Psychiatric Association, 1994). Studies in high-income settings have found significant association between higher depressive symptoms and underweight ($\text{BMI} < 18.5 \text{ kg/m}^2$) among adults (de Wit et al., 2009; Martin-Rodriguez et al., 2016), and in one qualitative study in Malawi, women also described losing weight as a symptom of perinatal psychological distress (Stewart et al., 2015). In urban Tanzania, not eating well and weight loss were attributed to lack of access to food and not as idioms of distress for distressed pregnant women (Kaaya et al., 2010).

Although Eastern DR Congo remains politically unstable with continued episodes of violence, experiencing conflict-related violence did not emerge as a source of psychological distress for participants in the present study. Participants were more likely

to discuss the death of children or extreme financial hardship as traumatic events in their lives. This is consistent with recent literature arguing for the relative importance of daily stressors compared to past traumatic events contributing to mental health problems (Miller & Rasmussen, 2010a, 2010b). However, a recent study in Timor Leste found that conflict-related traumas were associated with maternal depressive symptoms, but no other studies have explored potentially traumatic events as a pathway to depressive symptoms among mothers (Silove et al., 2015). Several prior studies in South Kivu have focused on the mental health of sexual violence survivors or those who have experienced conflict-related trauma (Bass et al., 2013; Glass et al., 2014; Kohli et al., 2014a; Hall et al., 2014); these studies occurred several years prior and in a geographic area that experienced greater insecurity, which could explain why sexual violence and trauma were not frequently reported in the present study.

Participants also did not mention intimate partner violence when discussing their relationships with their husbands. Although participants did not mention it specifically, intimate-partner violence is highly prevalent in Eastern Congo and may have contributed to poor spousal relationships (Tlapek, 2014; Peterman et al., 2011). A cycle of violence model has been proposed in other post-conflict settings in which men exposed to war-related traumatic events are at increased risk of enacting intimate partner violence and violence against children (Rees et al., 2015; Saile et al., 2014). Even though participants did not report experiencing conflict-related sexual violence, the cycle of violence model suggests that conflict may have contributed to higher levels of violence in the home.

Participants perceived that stressful events and psychological distress were linked with difficulties breastfeeding, sometimes directly and sometimes mediated by perceived

milk-insufficiency due to stress or weight loss/poor maternal nutritional status. It has been previously reported that stressful events can suppress breastmilk production, and social/partner support has also been identified as an important factor for breastfeeding (Dewey, 2001; Razurel et al., 2011; Groleau & Cabral, 2009). In Zimbabwe, both social support and perceived milk sufficiency were predictors of exclusive breastfeeding (Desai et al., 2014). In rural Pakistan, maternal depression was associated with perceived milk insufficiency, and in Kenya, women from food insecure households were more likely to believe their milk to be insufficient (Rahman et al., 2016; Webb-Girard et al., 2012).

Difficulties with complementary feeding were more often associated with mothers' inability to afford adequate quantity and quality of foods for their children, which was also found from formative research conducted for the parent study (Burns et al., 2016). One study in Bangladesh also found that mothers perceived poverty as a barrier to feeding their children nutritious foods (Hackett et al., 2015), and lower household wealth has been identified as a correlate of sub-optimal complementary feeding practices in quantitative studies from as well (Bernal Rivas & Lorenzana Albert, 2003; Senarath et al., 2012). Some participants described a decrease in affection towards their children in times of distress. This finding is supported by other literature showing an association between maternal depression, insecure attachment and lower quality of mother-child bonding (Moehler et al., 2006; Martins & Gaffan, 2000). Insecure attachment is in turn related to feeding problems and non-organic failure to thrive in infancy (Chatoor et al., 1998).

A number of studies have found an association between maternal mental health problems and child undernutrition, yet this is the first to assess mothers' perspectives and

awareness of how psychological distress affects maternal functioning, child care and feeding practices, and child nutritional status. The validity of the findings was confirmed by key informant interviews, which supported the relevancy of the themes emerging from in-depth interviews and focus group discussions. Another strength of the study was the purposive sampling technique, which achieved balance across the intervention groups.

In terms of limitations, intervention group assignment may have biased the responses of some participants. For example, PM2A group members received education and behavior change messaging on child feeding practices, thus they may have been more aware of child feeding problems. The vignettes that were used to facilitate the interviews and focus groups discussion may have been leading. However, there were differences in high and low distress participants' responses, and the trauma-focused vignette did not resonate with most participants, which indicates that participants' responses were not biased due to the vignettes. IDI and FGD findings were also triangulated by the key informant interviews. Another limitation was that the sampling strategy was based on participants' cumulative mental health symptom score, representing HSCL-25 (measuring depression/anxiety symptoms), HTQ (measuring PTSD symptoms), and 14 other locally relevant symptoms, thus the study did not differentiate between those who had depression/anxiety symptoms versus PTSD symptoms. Although HSCL-25 and HTQ scores were highly correlated ($r(34) = 0.90, p < 0.001$), it is possible that symptoms of different disorders may have manifested differently in terms of their relations to child feeding behaviors, which this study did not capture. There was a five-month gap in between when the maternal mental health assessment was conducted and when the interviews and focus groups were conducted. Therefore, it is possible that classifications

of low and high distress based on the mental health assessment were not accurate, if mental health symptoms were alleviated or worsened over the five-month period in between assessments.

The study occurred in the context of a large-scale intervention designed to increase household income and food security, yet the experiences of the participants indicated that many remained disempowered, in a state of acute economic distress and lacking financial decision-making power in the household. Family-focused interventions that target fathers may be an effective way to address maternal mental health problems and child undernutrition, as the lack of a supportive husband was a factor contributing to both problems. In high-income countries, responsible parenting interventions have increased fathers' involvement, but these interventions have not been widely evaluated with regard to maternal and child health outcomes (Magill-Evans et al., 2006; Doherty et al., 2006). In Uganda, a community-based cluster randomized trial of a parenting intervention focusing on child care and maternal well-being targeted at mothers increased child cognition scores and reduced maternal depressive symptoms, but had no impact on child growth (Singla et al., 2015). The inclusion of fathers in such an intervention strategy may provide further benefits to both mothers and children.

Additionally, more resources should be devoted to breastfeeding counselling and support for mothers to continue breastfeeding even when distressed. Breastfeeding counselling and education programs are often implemented in humanitarian emergencies to support continued breastfeeding for traumatized and displaced mothers, and group-based psychosocial interventions integrated with emergency feeding programs be effective in reducing maternal distress (Morris et al., 2012; Action contre la Faim-

France, 2014). The adaptation of integrated infant feeding and psychosocial support interventions to post-conflict, non-emergency contexts has the potential to benefit mothers and children and warrants further evaluation.

In summary, husbands' infidelity, abandonment, and lack of financial support were reported as a common source of psychological distress, along with poverty and food insecurity. High distress participants perceived that psychological distress made them lose their appetite or lose weight, and also affected functioning, such as one's ability to work and care for children. Psychological distress was perceived to be associated with insufficient breastmilk, as well as a decrease in affection towards children. Low distress participants tended to have better relationships with their husbands, greater social support from extended family or friends, and did not perceive there to be a link between psychological distress and breastfeeding or impaired functioning. Further research is needed to evaluate responsible parenting interventions targeted at fathers, which may alleviate symptoms of maternal mental health problems and improve child outcomes. The overwhelming psychological distress expressed by many participants indicates that policy-makers and programs should increase resources for women's mental health programs in impoverished, food insecure settings like DR Congo.

Table 5.1: Background Characteristics of 35 Mothers Participating in In-Depth Interviews and Focus Group Discussions

	Mean (SD) or N (%)
Age	30.2 (6.9)
Intervention Group ¹	
WEG	9 (25.7)
PM2A	11 (31.4)
FFS	5 (14.3)
F2F	4 (11.4)
Control	6 (17.1)
Territory	
Uvira	17 (48.6)
Fizi	18 (51.4)
Living in Territory of Origin	21 (61.8)
Married	33 (94.3)
Education	
None	14 (41.2)
Some primary school	11 (32.4)
Some secondary school	9 (26.5)
Severely Food Insecure	26 (74.3)
Household Size	8.3 (2.9)
Household Income (median, IQR) ²	30,000 (7,000, 50,000)
Number of Children	6.3 (4.2)
Ethnic Group	
Mubembe	17 (48.6)
Mufuliro	15 (42.9)
Other	3 (8.5)
HSCL-25 Score ³	2.53 (0.73)
HTQ Score ⁴	2.36 (0.78)
High Distress ⁵	22 (62.8)
Low Distress ⁵	13 (37.1)

¹WEG= Women's Empowerment Group, PM2A= Prevention of Malnutrition in Children under 2 Approach, FFS= Farmer Field Schools, F2F= Farmer to Farmer.

²Income in past month, Congolese francs.

³Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms with higher scores indicating greater severity of symptoms (range 1-4).

⁴Harvard Trauma Questionnaire measuring post-traumatic stress symptoms with higher scores indicating greater severity of symptoms (range 1-4).

⁵High and low distress participants scored in the upper and lower quartiles, respectively, of overall mean item mental health score, which included HSCL-25 and HTQ items, along with 14 locally-relevant items.

Figure 5.1: Analytical Tree of Code Categories and Codes

1. Relationship with Husband

- 1.1 Abandonment or marriage/relationships with other women
- 1.2 Doing poorly during husband's absence
- 1.3 Doing well despite husband's absence
- 1.4 Problems with husband's family
- 1.5 Feeling mocked/stigmatized due to husband's abandonment
- 1.6 Divorced or left husband
- 1.7 Husband doesn't provide money or support
- 1.8 Husband doesn't allow wife to work
- 1.9 Worried about getting HIV/STDs from husband

2. Other Stressors

- 2.1 Child death
- 2.2 Child illness/malnutrition
- 2.3 Poverty and/or food insecurity
- 2.4 Violence

3. Effects of Stressors and Psychological Distress

- 3.1 Children become sick or malnourished
- 3.2 Difficulty working and purchasing food/items
- 3.3 Decrease in affection towards child
- 3.4 Mother believes one should continue normal activities even when distressed
- 3.5 Maternal Health Problems
- 3.6 Maternal Lack of Appetite/Weight Loss

4. Child Care and Feeding Practices

- 4.1 Breastfeeding- difficulties because of mother working
- 4.2 Breastfeeding- difficulties when mother is feeling distressed
- 4.3 Breastfeeding- difficulties when mother is eating poorly
- 4.4 Breastfeeding- no problems
- 4.5 Complementary feeding- foods
- 4.6 Complementary feeding- frequency
- 4.7 Complementary feeding- difficulties because of poverty
- 4.8 Complementary feeding- difficulties because mother has too many children
- 4.9 Child care when mother is working

5. Positive Outcomes

- 5.1 Children in good health
- 5.2 Good relationship with husband

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CHAPTER 6: DISCUSSION

Maternal depression is highly prevalent in low and middle-income countries, with an estimated 20% of mothers experiencing depressive symptoms in the postpartum period (Fisher et al., 2012). Less is known about mothers' experiences of anxiety disorders, but those living in conflict-affected regions may be at increased risk of post-traumatic stress disorder (PTSD) (Tol et al., 2011). Eastern DR Congo was the center of a protracted conflict that has taken the lives of over 5 million people, and nation-wide over a million women have experienced sexual violence (International Rescue Committee, 2007; Peterman et al., 2011). Both the mental and physical health of the population is of major concern, with an estimated 40% of adults in Eastern Congo meeting symptom criteria for depression and 50% experiencing symptoms of PTSD (Johnson et al., 2010).

The nutritional status of the population is also poor. In South Kivu province, 7% of women are underweight and 11% have short stature, 53% of children under five are stunted, and 21% are underweight (*DRC DHS*, 2014). Only 9% of breastfed children and 2% of non-breastfed children consume a minimum acceptable diet according to WHO guidelines (*DRC DHS*, 2014; World Health Organization, 2010). With growing evidence for a link between the mental health of mothers and the diet and nutritional status of their children, it is important to understand how maternal mental health is related to their own diet and nutritional status, and the diet and nutritional status of their children, in post-conflict, humanitarian settings such as Eastern DR Congo.

This study presents a mixed methods assessment of the association between maternal mental health problems, maternal and child diet and nutritional status, and child feeding practices among mothers of young children in South Kivu, DR Congo. The study

employed an explanatory sequential design (Creswell, 2014). The quantitative research was conducted first, followed by a qualitative assessment with the purpose of explaining the findings from the quantitative results and to understand the pathways that might underlie any association between maternal mental health problems and maternal and child diet and nutritional status. The results of the study are presented in three papers. The first paper examined the association between symptoms of maternal mental health problems (depression/anxiety and PTSD) and maternal dietary and nutritional status. The second paper evaluated the association between maternal mental health symptoms and the diet and nutritional status of young children. The third paper was a qualitative assessment of mothers' perceptions of how their psychological state is linked to their functioning, particularly their child care and feeding practices. This chapter presents a summary of the main findings, the strengths and limitations of the study, and the implications of the research for future research and policy.

Maternal mental health was assessed using mean item scores on the Hopkins Symptom Checklist-25 (HSCL-25), measuring depression and anxiety symptoms, and the Harvard Trauma Questionnaire (HTQ), measuring PTSD symptoms (Derogatis et al., 1974; Mollica et al., 1992). A variable was constructed for high psychological distress, representing participants who scored in the upper quartile of both measures. A dietary diversity score, consisting of the average number of food groups mothers consumed over two recall days, was used to assess maternal diet. Body mass index (BMI) of non-pregnant mothers was assessed, and they were classified as underweight if they had a BMI of less than 18.5 kg/m². Pregnant mothers were classified as underweight if they had a mid-upper arm circumference of less than 23 cm.

Children's diet was assessed using WHO/UNICEF indicators for infant and young child feeding (World Health Organization, 2010). Dietary diversity and meal frequency were evaluated continuously, and dichotomous indicators for achieving minimum dietary diversity (≥ 4 of 7 food groups) and minimum meal frequency (based on thresholds of both 3 and 4 meals/snacks) were constructed. Child anthropometric measures included height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) z scores, and stunting (HAZ < -2) and underweight (WAZ < -2).

For the qualitative paper, in-depth interviews and focus group discussions were conducted with participants of varying levels of mental health symptomatology. Vignettes describing mothers with depression/anxiety and PTSD symptoms, which affected their functioning and child care and feeding practices, were used to facilitate the discussion. Key informant interviews were conducted local health workers in the study area to triangulate the in-depth interview and focus group findings.

6.1 SUMMARY OF MAJOR FINDINGS

The quantitative analyses presented in Chapters 3 and 4 yielded unexpected findings, and the results of the qualitative analysis in Chapter 5 generated new hypotheses that could help explain the lack of expected associations from the quantitative results. In Chapter 3, the association between symptoms of maternal mental health problems and mothers' diet and nutritional status was examined. Multivariate regression analyses adjusted for intervention group, education level, number of children, living in territory of origin, livelihoods zone, and self-reported health status. Higher HSCL-25 scores, indicating greater severity of symptoms, were associated with a significant increase in dietary diversity (β : 0.18, $p=0.002$). Higher HTQ score (β : 0.13, $p=0.017$) and having

high psychological distress ($\beta = 0.27, p = 0.003$) were also associated with higher dietary diversity. Overall, participants' diets were poor, with most consuming three or less food groups per day. BMI was negatively associated with higher symptoms of mental health problems, but the associations were not significant in both crude and adjusted models. Higher mental health symptoms were not associated with odds of underweight.

In high-income countries, symptoms of mental health problems among women are often associated with lower intake of micronutrients and greater desire for energy-dense foods (Hurley et al., 2005; Torres & Nowson, 2007; Konttinen, 2010). In rural DR Congo, it was hypothesized that higher levels of mental health symptoms are associated with lower dietary diversity, as distress would impair women's functioning and therefore decrease their ability to access to diverse foods. Loss of appetite is a symptom of depression and anxiety, thus lower dietary diversity could be indicative of eating less due to psychological distress (American Psychiatric Association, 2013). The findings of this analysis were in the opposite direction, as higher mental health symptoms were associated with greater dietary diversity. The qualitative research findings (Chapter 5) indicated that women perceived they were eating less in response to stress, thus it is unlikely that the findings could be explained by the phenomenon of emotional eating, which has been associated with depression and overweight/obesity in high-income countries (Emerson et al., 2016; Dallman, 2010).

In the qualitative research presented in Chapter 5, many participants described that loss of appetite and weight loss commonly occurred with periods of distress. Yet, this analysis failed to find a significant association between mental health symptoms and BMI or underweight. Seventy percent of the study sample was severely food insecure

and the household income in the past month was less than \$1 per day on average.

Women had an intensely physical work burden, often walking miles to the market or working in agriculture. Their energy needs may be greater than the energy available from their diet. These factors likely played a more significant role in women's nutritional status than their psychological state.

Chapter 4 examined the association between symptoms of mental health problems among 828 mothers and the diet and nutritional status of their children. Multivariate regression analyses adjusted for maternal age, intervention group, maternal education, and number of children. HSCL-25 (β : 0.18, $p=0.036$) and HTQ (β : 0.19, $p=0.026$) variables were associated with higher dietary diversity, but it was not associated with achievement of minimum dietary diversity. All maternal mental measures were positively associated with higher meal frequency (HSCL-25: β : 0.13, $p=0.001$, HTQ: β : 0.12, $p=0.001$, High Distress: β : 0.15, $p=0.014$). When defined by consumption of only three meals/snacks per day, achievement of minimum dietary diversity was associated with all mental health measures (HSCL-25: OR: 2.06, HTQ: OR: 1.93, High Distress: OR: 2.68, $p<0.001$ for all). No significant associations were found between maternal mental health and height-for-age z score, weight-for-age z score, weight-for-height z score, stunting, or underweight.

Similar to the results described in Chapter 3, these findings are surprising in light of the qualitative research results presented in Chapter 5, which indicated that child feeding practices and mothers' perceptions of child nutritional status are influenced by maternal psychological distress. The lack of significant results linking maternal mental health problems to child anthropometry may be due to the older age of the children (2-5

years), as children in this age range are less vulnerable to nutritional insults. Other studies in sub-Saharan Africa did not find an association between maternal mental health problems and child stunting and/or underweight (Medhin et al., 2010; Harpham et al., 2005; Tomlinson et al., 2006; Nguyen et al., 2014).

The effects of maternal mental health on child growth may be difficult to identify in these contexts, given the generally poor growth profiles of the children, the high prevalence of food insecurity, and the overall poor socio-economic status of the populations (Stewart, 2007). The findings of the qualitative research presented in Chapter 5 did not indicate that mothers perceived that they fed their children more frequently or fed more diverse foods in times of distress, despite the significant association between higher mental health symptoms and higher meal frequency identified in Chapter 4.

The objective of the qualitative assessment presented in Chapter 5 was to understand how mothers' perceptions of psychological distress may affect daily functioning, particularly regarding infant and young child feeding practices. Participants (n= 35) were recruited for in-depth interviews and focus group discussions from those who had both high and low levels of mental health symptoms, with efforts to achieve balance across intervention groups and geographic areas. The most salient theme to emerge was that husbands were a source of distress due to abandonment and infidelity, and in many cases also contributed to household food insecurity and poverty by spending income outside the household. Poverty and food insecurity were other major sources of stress, described as "psychological traumas" by one health worker. Participants described psychosomatic symptoms of distress, such as a "hurting heart" as well as

feeling pain and falling ill. Loss of appetite and weight loss were due to psychological distress were frequently reported.

With respect to perceptions of how psychological distress affects functioning, participants universally agreed that household tasks, agricultural activities, preparing food, and being able to pay for children's clothing and school fees is difficult for a mother experiencing psychological distress. Participants did not make a direct link between psychological distress and changes in complementary feeding practices (feeding more diverse foods or frequency in feeding), but acknowledged that it would be more difficult to provide food for children generally in times of distress. They made a more direct link between psychological distress and breastfeeding, as they felt that psychological distress made it more difficult to breastfeed. One participant said, "When you have problems, you don't breastfeed like you should, you sit there with your hand on your forehead and a lot of worries and pain in the heart" (Uvira FGD). In many instances, they believed they had insufficient milk due to stress, which made it difficult to breastfeed. Sometimes they felt their own stress-related weight loss was the reason their milk was insufficient. These themes were supported by the key informant interviews, which confirmed that marital problems and poverty were major stressors for mothers, and that psychological distress had a negative impact on mothers' functioning, particularly in the area of child feeding practices.

Although the results of Chapter 5 did not shed light on why mothers reported more diverse diets and fed their children more frequently with greater psychological distress (the results of Chapter 3 and 4 analyses), they did imply psychological distress impeded their ability to breastfeed, leading to early introduction of complementary foods.

They did not report changes in complementary feeding practices or types of foods consumed during times of distress. The children evaluated in the Chapter 4 analysis were no longer breastfed, thus if breastfeeding is the primary mechanism underlying an association between maternal mental health and child nutritional status, this could explain the lack of findings.

6.2 STRENGTHS AND LIMITATIONS

A primary strength of this study is the mixed methods approach. Mixed methods are useful for understanding the pathways underlying associations, which is important for the design of interventions (Zhang, 2014). In this study, the qualitative results provided some explanation for the lack of expected findings in the quantitative study. Without the qualitative analysis, it would be easy to conclude that there was no relationship between maternal mental health and adverse diet and nutrition outcomes, yet the interviews and focus groups revealed that mothers perceived their psychological state to have significant influence over their ability to breastfeed. The qualitative research also provided insight into the main stressors facing women in this context, which would not have been apparent from the quantitative mental health questionnaire alone.

Another strength of the study was the use of a questionnaire to measure mental health symptomatology that was developed specifically for the study setting. Bass et al. conducted qualitative research in several linguistic groups in South Kivu province, and on the basis of the findings selected mental health measures (HSCL-25 and HTQ) that were relevant to the idioms of distress reported in the qualitative results (Bass et al., 2013). Thus, the mental health questionnaire was an appropriate measure of mental health symptomatology for this population from a linguistic and cultural standpoint.

To our knowledge, this is the first study to assess PTSD symptoms in relation to child nutrition outcomes, and the first study to evaluate maternal mental health in relation to child diet and nutritional status in a post-conflict setting. Additionally, this study evaluated both maternal and child outcomes, whereas most studies on this topic concern only child outcomes. It is important to understand the impact of maternal mental health problems on maternal diet and nutritional status, as mothers' physical health will also impact the health of their children. By only focusing on child outcomes, we may lose sight of the big picture in terms of the impact that maternal mental health problems have on the maternal-child dyad.

The main limitation of this study was the age range of children enrolled, which was beyond the period of vulnerability in which maternal mental health problems would have the most impact on diet and growth (Victora et al., 2010; Ruel et al., 2008). Children in this age range were likely to have been left in the care of older siblings during the day, which may have impacted the reliability of dietary data reported by mothers. Although mothers often had younger children than those assessed, this study was conducted as part of data collection for a larger study; child data were only available from those enrolled in the parent study. Over 60% of children in the sample were stunted and the study population had a poor diet, regardless of maternal mental health status. There was limited variability in outcome measures, and the restriction of range may have limited the study's ability to detect an association.

The mental health questionnaire may also have been a limitation to the study, as the measures used were selected for use with sexual violence survivors and are frequently used among populations that have experienced trauma. Despite ongoing insecurity in

Eastern Congo, Uvira and Fizi territories were fairly stable at the time the present study occurred, and few participants reported ever experiencing sexual violence. Thus, other measures more commonly used to assess maternal mental health, such as the WHO Self-Reporting Questionnaire or the Edinburgh Postnatal Depression Scale, may have been more appropriate measures. However, approximately 60% of study participants had mean item HTQ scores that were indicative of probable PTSD, indicating that symptoms of post-traumatic stress were pervasive, although perhaps not associated with conflict-related trauma.

Another limitation is that the study did not collect data that could help in understanding if community or family support mechanisms existed for highly distressed participants, which may explain the association between higher symptoms of mental health problems and better indicators of children's diets. Additionally, the study did not collect data on how participants spent their time each day; this would have been useful in understanding if participants with higher distress had higher work burdens, resulting in higher incomes that may have allowed them to purchase more diverse foods for themselves and their children.

Finally, the qualitative aim used locally-relevant vignettes to facilitate conversation about a topic that may have otherwise been difficult for women to discuss, especially considering the low level of education in the population. Yet the vignettes may have been a source of bias in the qualitative results, as the mothers may have been led to agree with the issues presented by the scenarios. However, variation existed low and high distress participants' responses, and the trauma-related vignette did not resonate

with the participants, which imply that this was not the case. The results were also triangulated by the key informant interviews.

6.3 IMPLICATIONS FOR FURTHER RESEARCH AND POLICY

The significant association found between higher symptoms of mental health problems and higher maternal dietary diversity and child meal frequency warrant further study. An explanation for these findings did not emerge from the qualitative research, and it is possible that unmeasured confounding factors may explain these associations. The results of the anthropometric analysis are consistent with the findings of some other studies in sub-Saharan Africa among community-based samples that have found no association between maternal mental health problems and child growth. More research is needed to understand factors that could explain the lack of association. One potential factor is the role of other caretakers or social support mechanisms in child-rearing that may be serving as a buffer, mitigating the impact of reduced maternal functioning on child care and feeding. No other studies have assessed relations between PTSD symptoms and child nutritional status, and more research is needed in humanitarian settings, where risk factors for both psychological distress and undernutrition are elevated.

Other studies have shown an association between maternal depressive symptoms and child stunting and underweight, but there has been no rigorous testing of maternal psychosocial support and psychological interventions that may improve child nutrition outcomes. In Eastern DR Congo, cognitive behavioral therapy has been shown to be effective in reducing mental health symptoms among sexual violence survivors (Bass et al., 2013), but whether or not the benefits of such approaches reach children is unknown.

Opportunities for maternal psychosocial support could also be integrated with infant and young child feeding interventions, and health workers should be trained to recognize distressed mothers' need for increased breastfeeding support. Another intervention approach that may have benefits in this setting is a responsible parenting intervention targeted at men, with the goal of increasing their involvement and interest in child-rearing and child outcomes. Our study findings show that husbands' behavior was a major source of psychological distress for mothers and also contributed to household poverty and food insecurity. Behavior change strategies aimed at men might have a major impact on child health and nutrition outcomes, although ultimately cultural change is needed.

Finally, humanitarian organizations need to consider a greater focus on mental health and psychosocial support services within their programs, and offer greater support to health systems in training mental health care workers. Impoverished, rural communities such as those described in this study face chronic and acute stressors, and symptoms of depression and anxiety disorders are very relevant health concerns. Mental health interventions implemented at scale could make a major impact on improving well-being of not just mothers, but communities at large. Policy makers should consider the integration of maternal mental health and psychosocial support services with existing maternal and child health programs as part of a basic package of interventions in order to ensure that women and children are given the opportunity to achieve optimal mental and physical health.

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APPENDIX 1: Supplemental Results Tables

Supplemental Results Table A1.1: Associations between Maternal Mental Health Problems Classified by Alternate Cut-off Points and Maternal Dietary Diversity and Nutritional Status

Dietary Diversity Score (n= 776)						
	Crude			Adjusted¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.01	(-0.18, 0.19)	0.953	-0.10	(-0.29, 0.09)	0.296
Depression $\geq 1.75^3$	0.07	(-0.11, 0.25)	0.432	-0.03	(-0.21, 0.16)	0.785
Anxiety $\geq 1.75^4$	0.14	(-0.01, 0.29)	0.072	0.08	(-0.08, 0.24)	0.335
HTQ $\geq 2.5^5$	-0.05	(-0.19, 0.09)	0.498	-0.07	(-0.21, 0.07)	0.304
BMI (n= 616)						
	Crude			Adjusted¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	-0.07	(-0.65, 0.51)	0.817	0.11	(-0.48, 0.70)	0.722
Depression $\geq 1.75^3$	-0.35	(-0.92, 0.22)	0.234	-0.24	(-0.83, 0.34)	0.412
Anxiety $\geq 1.75^4$	0.05	(-0.45, 0.56)	0.839	0.22	(-0.29, 0.73)	0.398
HTQ $\geq 2.5^5$	-0.13	(-0.58, 0.31)	0.554	-0.11	(-0.56, 0.34)	0.625
Underweight (n= 761)						
	Crude			Adjusted¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	1.01	(0.55, 1.85)	0.981	0.88	(0.46, 1.68)	0.699
Depression $\geq 1.75^3$	1.28	(0.68, 2.44)	0.444	1.19	(0.60, 2.34)	0.618
Anxiety $\geq 1.75^4$	0.75	(0.46, 1.24)	0.262	0.62	(0.36, 1.05)	0.075
HTQ $\geq 2.5^5$	1.05	(0.66, 1.66)	0.838	1.03	(0.63, 1.69)	0.891

¹Adjusted for intervention group, age, education level, living in territory of origin, livelihoods zone, number of children, and health.

²24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4, scores ≥ 1.75 indicate significant emotional distress.

³14 items from the Hopkins Symptom Checklist-25 depression sub-scale, scores ≥ 1.75 indicate symptoms of probably depression.

⁴10 items from the Hopkins Symptom Checklist-25 anxiety sub-scale, scores ≥ 1.75 indicate symptoms of probably anxiety.

⁵16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4, scores ≥ 2.5 indicate symptoms of probably PTSD.

Table A1.2: Associations between Maternal Mental Health Problems Classified by Alternate Cut-off Points and Child Diet

Dietary Diversity Score (n= 724)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.33	(0.06, 0.60)	0.019	0.31	(0.03, 0.58)	0.030
Depression $\geq 1.75^3$	0.53	(0.26, 0.81)	0.000	0.52	(0.25, 0.80)	0.000
Anxiety $\geq 1.75^4$	-0.08	(-0.32, 0.16)	0.501	-0.11	(-0.35, 0.14)	0.389
HTQ $\geq 2.5^5$	0.21	(-0.00, 0.42)	0.054	0.21	(-0.01, 0.42)	0.057
Meal Frequency (n= 714)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.02	(-0.11, 0.15)	0.742	-0.01	(-0.14, 0.12)	0.921
Depression $\geq 1.75^3$	0.04	(-0.09, 0.17)	0.537	0.02	(-0.11, 0.15)	0.789
Anxiety $\geq 1.75^4$	0.04	(-0.07, 0.15)	0.487	0.02	(-0.09, 0.13)	0.726
HTQ $\geq 2.5^5$	0.12	(0.02, 0.21)	0.014	0.10	(0.00, 0.19)	0.043
Minimum Dietary Diversity (Consumed ≥ 4 Food Groups)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	1.15	(0.78, 1.72)	0.482	1.11	(0.74, 1.66)	0.627
Depression $\geq 1.75^3$	1.31	(0.87, 1.95)	0.192	1.27	(0.84, 1.92)	0.253
Anxiety $\geq 1.75^4$	0.81	(0.57, 1.13)	0.216	0.78	(0.55, 1.11)	0.168
HTQ $\geq 2.5^5$	0.96	(0.71, 1.29)	0.769	0.94	(0.69, 1.29)	0.709
Minimum Meal Frequency (Consumed ≥ 4 Meals)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	2.27	(0.29, 17.53)	0.432	omitted		
Depression $\geq 1.75^3$	2.22	(0.29, 17.13)	0.445	omitted		
Anxiety $\geq 1.75^4$	1.79	(0.40, 8.09)	0.448	omitted		
HTQ $\geq 2.5^5$	3.66	(0.81, 16.46)	0.091	omitted		
Minimum Meal Frequency (Consumed ≥ 3 Meals)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.98	(0.60, 1.58)	0.919	0.84	(0.51, 1.38)	0.482
Depression $\geq 1.75^3$	1.01	(0.62, 1.64)	0.980	0.88	(0.53, 1.46)	0.622
Anxiety $\geq 1.75^4$	1.18	(0.78, 1.79)	0.440	1.10	(0.72, 1.70)	0.653
HTQ $\geq 2.5^5$	1.67	(1.15, 2.41)	0.007	1.54	(1.05, 2.25)	0.027

¹Adjusted for intervention group, age, education level, living in territory of origin, livelihoods zone, number of children, and health.

²24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4, scores ≥ 1.75 indicate significant emotional distress.

³14 items from the Hopkins Symptom Checklist-25 depression sub-scale, scores ≥ 1.75 indicate symptoms of probable depression.

⁴10 items from the Hopkins Symptom Checklist-25 anxiety sub-scale, scores ≥ 1.75 indicate symptoms of probable anxiety.

⁵16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4, scores ≥ 2.5 indicate symptoms of probable PTSD.

Table A1.3: Associations between Maternal Mental Health Problems Classified by Alternate Cut-off Points and Child Nutritional Status

Height-for-Age Z Score (n= 746)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.12	(-0.11, 0.35)	0.307	0.12	(-0.11, 0.35)	0.315
Depression $\geq 1.75^3$	0.06	(-0.16, 0.29)	0.597	0.07	(-0.16, 0.30)	0.542
Anxiety $\geq 1.75^4$	-0.02	(-0.22, 0.18)	0.857	-0.01	(-0.21, 0.19)	0.904
HTQ $\geq 2.5^5$	-0.03	(-0.21, 0.14)	0.702	-0.04	(-0.21, 0.13)	0.655
Weight-for-Age Z Score (n= 750)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.06	(-0.12, 0.24)	0.527	0.05	(-0.13, 0.24)	0.562
Depression $\geq 1.75^3$	0.02	(-0.16, 0.20)	0.850	0.02	(-0.16, 0.21)	0.808
Anxiety $\geq 1.75^4$	-0.07	(-0.23, 0.09)	0.412	-0.07	(-0.23, 0.09)	0.396
HTQ $\geq 2.5^5$	-0.03	(-0.17, 0.10)	0.621	-0.02	(-0.16, 0.12)	0.780
Weight-for-Height Z Score (n= 753)						
	Crude			Adjusted ¹		
	β	(95% CI)	p-value	β	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	-0.01	(-0.19, 0.17)	0.925	-0.01	(-0.19, 0.17)	0.877
Depression $\geq 1.75^3$	-0.02	(-0.19, 0.16)	0.865	-0.02	(-0.20, 0.16)	0.818
Anxiety $\geq 1.75^4$	-0.07	(-0.22, 0.09)	0.392	-0.07	(-0.23, 0.09)	0.396
HTQ $\geq 2.5^5$	0.01	(-0.12, 0.15)	0.847	-0.02	(-0.16, 0.12)	0.780
Stunting (n= 746)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.89	(0.59, 1.34)	0.584	0.93	(0.61, 1.41)	0.719
Depression $\geq 1.75^3$	1.00	(0.67, 1.48)	0.981	1.02	(0.67, 1.54)	0.931
Anxiety $\geq 1.75^4$	1.10	(0.78, 1.56)	0.580	1.12	(0.78, 1.61)	0.546
HTQ $\geq 2.5^5$	1.19	(0.88, 1.61)	0.267	1.19	(0.87, 1.64)	0.274
Underweight (n= 750)						
	Crude			Adjusted ¹		
	OR	(95% CI)	p-value	OR	(95% CI)	p-value
HSCL-25 $\geq 1.75^2$	0.79	(0.51, 1.25)	0.315	0.80	(0.51, 1.27)	0.350
Depression $\geq 1.75^3$	0.79	(0.51, 1.24)	0.307	0.78	(0.49, 1.23)	0.278
Anxiety $\geq 1.75^4$	1.16	(0.76, 1.76)	0.487	1.18	(0.77, 1.82)	0.440
HTQ $\geq 2.5^5$	1.02	(0.72, 1.46)	0.901	0.98	(0.68, 1.41)	0.897

¹Adjusted for intervention group, age, education level, living in territory of origin, livelihoods zone, number of children, and health.

²24 items from the Hopkins Symptom Checklist-25 measuring depression and anxiety symptoms, range of scale scores 1-4, scores ≥ 1.75 indicate significant emotional distress.

³14 items from the Hopkins Symptom Checklist-25 depression sub-scale, scores ≥ 1.75 indicate symptoms of probable depression.

⁴10 items from the Hopkins Symptom Checklist-25 anxiety sub-scale, scores ≥ 1.75 indicate symptoms of probable anxiety.

⁵16 items from the Harvard Trauma Questionnaire measuring post-traumatic stress symptoms, range of scale scores 1-4, scores ≥ 2.5 indicate symptoms of probable PTSD.

APPENDIX 2: Interview and Focus Group Guides



Approved: 20 January 2016
IRB No.: 00006514

Factors Affecting Maternal Mental Health and Infant and Young Child Feeding Practices

Focus Group Discussion Guide- mothers

Version 2: January 13, 2016

Thank you for participating in this focus group discussion. The questions I am going to ask don't have right or wrong answers. We are interested in learning about your experiences and those of women in the community so we can better understand how to help mothers and children. I want this to be a group discussion, so you needn't wait for me to call on you. Please speak one at a time, though. We have a lot to cover, so I may change the subject from time to time or move ahead. Please stop me if you want to add something. I'm going to start out with reading a couple stories and then ask you some questions about them.

Vignette 1: Riziki is 23 years old and lives in this village. She has four young children, and lives with her husband, mother-in-law, and several other cousins and family members. Riziki works each day in the fields cultivating corn [substitute whatever is grown in that village]. At the end of the day, when Riziki comes home, she has to help with the cooking and cleaning. She is usually too tired and busy to play with her children. She is worried about her children not growing well and getting sick, but she doesn't feel like there is anything she can do for them. One day, after having a disagreement with her husband, he left for Bukavu and Riziki does not know if he will come back. Ever since then she stopped going to the fields and often stays home crying. Since she is not working, her family does not have the money to buy enough food for everyone.

Vignette 2: Helene is 34 and moved to this village with her parents when she was a girl to escape fighting in Burundi. She felt safe here until she found out that some soldiers nearby were stealing from local people and attacking women. One day, a group of soldiers came to the fields and attacked one of her friends, and stole all of the crops they grow. Now, Helene is afraid to go to the field even though she needs to earn money from selling her crops. She keeps having nightmares about what happened to her friend, and feels guilty that she didn't do anything to help her. Helene has two children, one is 6 months old and the other is two years old. Sometimes when her children cry now she doesn't respond to them because her mind is in another place. She thinks a lot, worrying about all the things happening in her life. She stops breastfeeding because she thinks all the stress has made her milk dry up. Her baby becomes malnourished, but when she brings him to the health center she can't concentrate on the advice the nurse is giving her.

- Can you tell me about women in your community who are like Riziki and Helene?
 - What kind of problems do they have?
 - What other problems affect women in the community?
 - What do people do when they have these kind of problems?
- Describe how women in the community feed and care for their children.
 - Who takes care of children on most days?
 - What does it mean to feed children well?



Approved: 20January2016
IRB No.: 00006514

- What makes it difficult for mothers to take good care of their children?

Is there anything else you would like to add? Thank you for your participation.



Approved: 20 January 2016
IRB No.: 00006514

Factors Affecting Maternal Mental Health and Infant and Young Child Feeding Practices

In-Depth Interview Guide- for Mothers

Version: January 13, 2016

Thank you for participating in this interview. The questions I am going to ask don't have right or wrong answers. We are interested in learning about your experiences. Hearing about your experiences will help us to better understand how to help mothers and children. You can decide to stop participating at any time. Do you have any questions before we begin?

To start out with, we are going to tell you two stories and then ask you some questions about them.

Vignette 1: Riziki is 23 years old and lives in this village. She has four young children, and lives with her husband, mother-in-law, and several other cousins and family members. Riziki works each day in the fields cultivating corn [substitute whatever is grown in that village]. At the end of the day, when Riziki comes home, she has to help with the cooking and cleaning. She is usually too tired and busy to play with her children. She is worried about her children not growing well and getting sick, but she doesn't feel like there is anything she can do for them. One day, after having a disagreement with her husband, he left for Bukavu and Riziki does not know if he will come back. Ever since then she stopped going to the fields and often stays home crying. Since she is not working, her family does not have the money to buy enough food for everyone.

Vignette 2: Helene is 34 and moved to this village with her parents when she was a girl to escape fighting in Burundi. She felt safe here until she found out that some soldiers nearby were stealing from local people and attacking women. One day, a group of soldiers came to the fields and attacked one of her friends, and stole all of the crops they grow. Now, Helene is afraid to go to the field even though she needs to earn money from selling her crops. She keeps having nightmares about what happened to her friend, and feels guilty that she didn't do anything to help her. Helene has two children, one is 6 months old and the other is two years old. Sometimes when her children cry now she doesn't respond to them because her mind is in another place. She thinks a lot, worrying about all the things happening in her life. She stops breastfeeding because she thinks all the stress has made her milk dry up. Her baby becomes malnourished, but when she brings him to the health center she can't concentrate on the advice the nurse is giving her.

- Can you tell me about women you know who are like Riziki or Helene?
 - Describe what other kinds of problems they have.
 - Any more problems?
 - Tell me about how these women's problems affect their families.
- Can you tell me about a time when you felt like Riziki or Helene?
 - Describe why you felt this way.
 - Describe the kinds of things that you worry about.
 - What other things do you worry about?
- Can you tell me about any problems you have in feeding your children?



Approved: 20 January 2016
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- How do you feel about breastfeeding?
 - Describe the kinds of foods you feed your children.
 - Who takes care of and feeds your children on most days? How do you feel about this person taking care of your children (if someone else).
- If someone feels like Helene or Riziki, how will this impact her daily tasks? Which activities do you think will be especially difficult?
 - Probe: if child caring issues are mentioned, ask exactly how this happens. For example, ask women to describe a situation in which a mother may be with her child, and the difficulties will show up

Thank you for your time. Is there anything else you would like to add or discuss with us today?



Approved: 20 January 2016
IRB No.: 00006514

Factors Affecting Maternal Mental Health and Infant and Young Child Feeding Practices

Guide for Key Informant Interviews

Version 1: January 13, 2016

Introduction: Thank you for participating in this interview/focus group discussion. We are interested in learning about your experiences as a health/nutrition worker so we can better understand how to help mothers and children. You can decide to stop participating at any time. Do you have any questions before we begin?

- Can you describe the kinds of problems women in the community have?
 - Any other problems?
 - Can you tell me about how these problems affect how mothers care for their children.
- Why are there problems with children's health and malnutrition in the community?
 - What are the main barriers to good child feeding practices?
 - Can you describe the kinds of problems women have with breastfeeding?
- How do you think we can provide better support to mothers to address the problems you described earlier?

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CURRICULUM VITAE

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EDUCATION

- 2013- **Doctor of Philosophy**, Department of International Health, Program in Human Nutrition, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
Dissertation title: *Maternal Mental Health and Maternal and Child Nutrition in Eastern DR Congo: A Mixed Methods Approach*
- 2011 **Master of Arts**, International Politics, American University School of International Service, Washington, DC.
Concentrations: Human Rights, Africa Regional Studies.
Semester study abroad program at Sciences Po Paris.
Substantial Research Paper: *Evaluating National Human Rights Institutions in Africa*
- 2008 **Bachelor of Arts**, International and Comparative Politics, American University of Paris, Paris, France.
Minor: International Law
Senior Seminar Thesis: The Use of Sexual Violence as a Weapon of War: Case Studies from Rwanda, the former Yugoslavia, and Darfur

PROFESSIONAL EXPERIENCE

- 2014- 2016 **Graduate Research Assistant**, Center for Refugee and Disaster Response, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD and South Kivu, Democratic Republic of Congo.
Responsibilities: Coordinated a study evaluating Jenga Jamaa II, a USAID Food for Peace project. Oversaw transition to electronic data collection, organized and supervised twice-yearly surveys of over 1,800 households enrolled. Conducted longitudinal analysis to determine effectiveness of project interventions on household food security and child diet and nutrition outcomes, and drafted reports to partners and donors.
- 2014 **Graduate Research Assistant**, Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
Responsibilities: Searched databases for peer-reviewed articles and determined whether they met eligibility criteria for inclusion in a

systematic review and logical framework analysis of Mental Health and Psychosocial Support monitoring and evaluation programs in humanitarian settings for a UNICEF and UN Inter-Agency Standing Committee project.

- 2013-2014 **Graduate Research Assistant**, Center for Human Nutrition, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD.
Responsibilities: Developed a database for analysis of dietary intakes of South African children 9-26 months of age for the NIH and Gates Foundation-funded project *Etiology, Risk Factors, and Interactions of Enteric Infections and Malnutrition and the Consequences for Child Health and Development (MAL-ED)*.
- 2012-2013 **Emergency Nutrition Program Manager**, GOAL Global, Maban County, South Sudan.
Responsibilities: Oversaw the development and implementation of emergency nutrition programs in Batil refugee camp and Jamam host community, including blanket and targeted supplementary feeding, infant and young child feeding, and outpatient therapeutic feeding programs. Collaborated closely with World Food Program, UNHCR and NGO counterparts. Recruited local and regional staff, ensured timely reporting to donors, and managed the procurement and distribution of food commodities.
- 2012 **Consultant**, Save the Children International, Léogâne, Haiti.
Responsibilities: Conducted assessment on maternal, child, and reproductive health services in Léogâne and organized trainings for 70 community health workers on behavior change communication.
- 2011-2012 **Program Manager**, Children's Nutrition Program of Haiti, Léogâne, Haiti.
Responsibilities: Directed community-based nutrition education programs, outpatient therapeutic feeding program, water and sanitation programs, and mobile medical teams. Developed three-year strategic plan, redesigned program activities, developed system for monitoring and evaluation. Supervised over 35 national and expatriate staff, coordinated with Ministry of Health, UNICEF, and other partners. Designed and implemented baseline survey prior to launching restructured programs.
- 2010 **Project Coordinator**, The RAISE Project, Society for Women's Health Research, Washington, DC.
Responsibilities: Tracked and analyzed information on scientific awards processes for campaign to recognize women's achievements in STEM fields. Updated database and communicated regularly with project advisors at NIH and Institute of Medicine.

- 2009-2010 **Research Assistant**, American University, Washington, DC.
Responsibilities: Investigated human rights implications of the U.S. use of private military contractors in Africa, African responses to the U.S. Africa Command, and African conflicts and power-sharing agreements for Professor Carl LeVan's publications and lectures.
- 2008 **Intern**, Tostan, Tambacounda, Senegal.
Responsibilities: Interviewed program participants and communicated their stories in donor reports and promotional materials for Dakar-based NGO that promotes women's health and human rights.

TEACHING EXPERIENCE

- 2016 **Instructor**, Johns Hopkins University, Baltimore, MD
 Taught one-credit self-designed course "Introduction to International Nutrition" for undergraduate summer session. Created learning objectives and syllabus, drafted lecture slides and in-class activities, and designed student assessments.
- 2016 **Graduate Teaching Assistant**
Food/Nutrition and Livelihoods in Humanitarian Emergencies (4th Quarter), Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; Instructor: Shannon Doocy, PhD.
- 2015 **Graduate Teaching Assistant**
Assessment of Nutritional Status (2nd Quarter), Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; Instructor: Kerry Schulze, PhD.
- 2015 **Graduate Teaching Assistant**
Introduction to International Health (4th Quarter, online), Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; Instructor: William Brieger, DrPH.
- 2014 **Graduate Teaching Assistant**
Principles of Human Nutrition (1st Quarter), Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; Instructor: Kristen Hurley, PhD.

PROFESSIONAL TRAINING

- 2016 Preparing Future Faculty Teaching Academy Certificate
 Johns Hopkins University, Baltimore, MD

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| 2016 | Summer Teaching Institute
Johns Hopkins University, Baltimore, MD |
| 2016 | Certificate in Public Mental Health Research
Johns Hopkins University, Baltimore, MD |
| 2014 | An Introduction to Evidence-Based Undergraduate STEM Teaching
Vanderbilt University, Coursera Online Course |
| 2013 | Infant and Young Child Feeding, Integrated Management of Severe Acute Malnutrition, and Basics of Nutrition in Emergencies Certificate
UNHCR, UNICEF, and Upper Nile Ministry of Health, Bunj, South Sudan |
| 2011 | Community Management of Acute Malnutrition Certificate
Haiti Ministry of Health and UNICEF, Port-au-Prince, Haiti. |

LANGUAGES

French: fluent, written and oral
Haitian Creole: advanced, written and oral
Spanish: intermediate, written and oral

HONORS AND AWARDS

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| 2016 | Harry D. Kruse Publication Award in Nutrition |
| 2016 | Harry D. Kruse Fellowship in Nutrition, |
| 2015 | Harry J. Prebluda Fellowship in Nutritional Biochemistry |
| 2015 | George Graham Endowment Travel Award |
| 2013 | Bacon Field Chow Memorial Fellowship |
| 2013-2016 | Department of International Health Tuition Scholarship |
| 2008 | Dean's List, American University of Paris |

PROFESSIONAL MEMBERSHIPS

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|-----------|---|
| 2014- | American Society for Nutrition |
| 2014-2015 | American Public Health Association |
| 2011-2012 | Comité Technique de Nutrition/Nutrition Cluster, Port-au-Prince, Haiti. |

PUBLICATIONS

Burns, J., **Emerson, J. A.**, Amundson, K., Doocy, S., Caulfield, L. E., & Klemm, R. D. (2016). A Qualitative Analysis of Barriers and Facilitators to Optimal Breastfeeding and Complementary Feeding Practices in South Kivu, Democratic Republic of Congo. *Food and Nutrition Bulletin*, 37(2), 119-131.

Emerson, J. A., Hurley, K. M., Caulfield, L. E., & Black, M. M. (2016). Maternal mental health symptoms are positively related to emotional and restrained eating attitudes in a statewide sample of mothers participating in a supplemental nutrition program for women, infants and young children. *Maternal and Child Nutrition*. Doi: 10.1111/mcn.12247 [E-pub ahead of print].

PRESENTATIONS

Maternal Mental Health Symptoms are Positively Associated with Disordered Eating Attitudes in a Statewide Sample of WIC Participants. Experimental Biology, Boston, MA, March 30, 2015. Poster.

Maternal Mental Health Symptoms are Positively Associated with Disordered Eating Attitudes in a Statewide Sample of WIC Participants. Delta Omega Poster Competition, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, February 4, 2015. Poster.

The Political Economy of African Responses to the U.S. Africa Command, Institute for Policy Studies, Washington, DC, October 1, 2010. Talk.